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UNREASONABLE FRANCHISE EXACTIONS.

Very often the city fathers, in drawing up an ordinance for the regulation of the relations of the municipality and a corporation exercising a quasi-public function, are eager to impose exactions which will make it imperative for the company desiring a franchise to treat all people applying for service exactly alike. This has led to considerable loss on the part of the telephone companies, and the reason for it is not hard to see if any close analysis is made of the possibility of irresponsible persons demanding and securing service for which they are unable to pay.

The electric-lighting company usually brings its feeders to a point either outside or just inside of a residence or factory building, and the gas company is responsible only so far as its street mains and house connections are concerned. The telephone company, on the other hand, takes care of its own street distribution and carries its wiring scheme through the building to its own instrument, which it leaves ready for service upon the premises of the subscriber.

In discussing the subject of credit co-operation among manufacturers, and the necessity for a close analysis of the credit of those asking for service from a quasi-public corporation, a prominent telephone man, speaking before an electrical gathering recently, stated that under its ordinance, his company was expected to give service to everybody who demanded it. At one time during the present year there were something like 3,800 requests for nickel-telephone service. A credit department was established, and these 3,800 requests were dumped into this department, and in a short time 2,500 of them were returned as being unable to pass muster for apparent ability to pay their bills. The installation of wiring and the telephone instrument for these subscribers would have occasioned a very great investment upon the part of the telephone company, so it was decided to address a brief letter to these apparently irresponsible ones, with the request that they post a deposit of $9 with the telephone company as a guarantee of good faith, with the understanding that if the bills were properly met for a period of one year, they would have returned to them the sum of $10, which would, of course, include their original payment and interest thereupon. Out of 2,500 possible subscribers thus addressed only 400 either put up the deposit of $9 or secured a guarantee from parties such as the telephone company could deem reliable. As a further indication of the irresponsibility of large numbers of people who will exact a service, even though unable to pay for it, out of another 2,500 subscribers who actually did receive service, 300 fell down the first month, 400 the second month and something like 600 the third month.

CENTRAL-STATION LOCATION OUTSIDE CITIES.

Within the past two or three years the location of central stations outside the immediate centres of distribution which they serve has become sufficiently frequent to justify comment. While local conditions are obviously responsible for this departure from former practice in cases that have been given thorough engineering study, the tendency is none the less marked. Usually the problem has been solved in connection with the re-location of a plant at a time when the growth of the old station demands a large addition in capacity, with provision for a number of years' expansion. The progress lately made in the field of high-voltage transmission justifies taking a wider view of the power supply question for any given community than was possible in the old days when the ideal of the plant designer was to locate his machinery as close to the centre of distribution as real estate restrictions and water supply would permit.

There are more advantages in locating a plant at some distance from an urban centre than are always appreciated, in view of the general tendency of central stations in the majority of communities to adopt 2,300 volts as the standard of service. The increasing cost of real estate, the rapid growth of the power business and the expansion of lighting loads, the tendency of city taxation to mount upward, the development of adjacent territory and property, the difficulty and great cost of purchasing land for extension, smoke restrictions, crusades against noise, restrictions against coaling at the most convenient hours, and the pressure of commerce against the station walls, all point the way toward a location of the plant ultimately on a site less cramped, following the course of many industrial establishments in their re-location in the suburban sections of large municipalities, with new equipment and better opportunities for development along the best lines.

The location of a station on a piece of land in a small town adjacent to the city mainly supplied enables the company to design the plant according to its own ideas, without interference from over-zealous municipal regulations. At moderate cost, usually, sufficient land can be obtained to provide for many years' growth along whatever lines engineering development dictates, and the operation of the new station can be vastly facilitated by the low cost of space on the new property. It is a great mistake for a company building a new station on a suburban or rural site, to crowd the apparatus as though operation were to be carried on in a congested city district, and yet one of the latest examples of a transplanted station illustrates a case of this kind. In the instance in mind, the old steam plant in the centre of the city became inadequate in both capacity and economy of power production, and a new station with the latest turbine equipment was built by the company in an adjoining town, to supply all power through the original plant location as a distributing substation. Unfortunately the new station is so crowded that passage through the building is devious and difficult, the handling of machinery parts is less flexible than is desirable, and the operation of the station is clearly hindered by the cramping of equipment. The location of the plant on land so cheap that the expansion of the next twenty-five years, if not of the next half-century, is provided for by the area purchased, ought to have predicated a station of ample design, even at some relatively small increase in first cost of building, piping and wiring runs.

The more remote site similarly affords larger and less costly coal-storage facilities. If the plant is located beside a railroad track or on a navigable stream, the cost of coal per ton may be considerably reduced through lessened expense in handling, avoidance of teaming, ease of installing telpher systems or electric traveling grab-bucket equipments of moderate cost which might be precluded entirely in the more constricted site of the old station. The cost of water for boiler feed may be considerably reduced also, by a location outside the city. In not a few cases the housing of the station employees may be solved in a much better way than is possible in the city proper, although the provision of hours of labor that will allow a certain amount of relaxation is a very important factor in retaining the services of desirable men when a plant is moved to some out-of-the-way suburban point.

The only objection of serious character against these locations of the newer central stations is the question of service reliability and cost of transmission. The integrity of the transmission to the substations or distributing centres must be absolutely established. At the moderate voltages usually required in these central-station services, with distances rarely exceeding a dozen miles or so, there is little excuse for the failure to maintain continuous service. A 13,200-volt transmission offers no difficulty to an experienced engineer in these days, and where 2,300 or 6,600 volts are adequate, interruptions should be few and far between. When the service of a good-sized city depends upon a plant located outside the centre of population, it may pay to install at least two lines in the interest of service continuity. The cost of transmission, including fixed charges, needs to be carefully figured in planning the location of a station in a suburban territory, together with the probable development of loads in the vicinity of the plant. Where the cost of power production is high at the old plant on account of obsolete or depreciated equipment, unfavorable operating conditions, or excessive taxes, a line of moderate length is not likely to interpose a transmission cost unfavorable to the location of the new plant outside. An important point to make certain of before beginning construction is the rate of taxation or possible exemptions to be secured the company through its location in a given suburb. The small town can afford to make it an object to the lighting company to locate in it, generally speaking, for even a moderate rate of taxation on a plant of, say, 5,000 kilowatt rating, means a revenue of large proportions from the point of view of town administration. If concessions of this kind can be secured, the lighting company will generally be able to repay them by bringing increased business of various kinds to the town, giving it new life industrially through cheap power, increasing in and out freight and express business, helping the postal receipts and bringing business to certain retail merchants through the visits of officials to the community in connection with the plant affairs, and by improving the standards of street illumination.

THE GAS APPLIANCE EXPOSITION.

One of the recent events of considerable interest to manufacturers of electrical appliances and to central-station men was the Gas Appliance Exposition, held under the auspices of the National Commercial Gas Association, and the American Gas Institute, in Chicago. The exhibit was remarkably complete, and attracted a great deal of attention. The gas men received and deserved a considerable meed of praise for the extent to which this industrial indication of the magnitude of the gas industry was handled, and, as one of the prominent gas men put it: "The gas men are wondering why they didn't do this thing long ago, now that they have found out that they really could do it."

One thing was noticeable, and this must bring a good deal of satisfaction to the designer of electrical fixtures and the central-station man: The chandeliers which attracted the greatest amount of attention, and which, per se, were most usable and likable, both from an æsthetic and utilitarian standpoint, were fashioned absolutely in imitation of electric fixtures and appliances. One fixture, however, an excuse for the design of which it is hard to find, was a gas arc using inverted gas mantles and an alabaster round globe; in carrying out the imitation of the arc lamp even the casing which the manufacturers of electric arcs must use in order to protect and conceal the works of the lamp has been conscientiously copied.

Electrical ignition systems seem not to be very popular, for not one was noticed at this very extensive exposition of gas appliances. Pilot-lighting systems operated by compressed air and by electromagnetic control, and also pyro-electric spontaneous igniters, were in evidence. At the present time a combination pneumatic-pilot-lighting system appears to be the most dependable, as was pointed out in one of the papers dealing with the improvements in gas-ignition devices read at the recent convention of the Illuminating Engineering Society.

Another feature which attracted much notice from the electrical men in attendance at the exposition was the fact that in almost every case where motive power was required, small electric motors were used, where it would appear there was an excellent chance for the exploitation of small gas engines, if any were available.

THE ELECTRICAL INDUSTRY IN GREAT BRITAIN.

Some five years ago a council of ponderous intellects passed a resolution declaring, in so many words, that although the engineers of Great Britain had contributed largely to the wealth and standing of the nation and the world, technical education and recognition of technical worth appeared to be backward. This was all occasioned through the passage by the British Parliamentary committees of certain stultifying restrictions and regulations which, it was feared, would make impossible the development of new inventions and their application to electrical undertakings in Great Britain.

Certainly, the unwise, though well-meant, restrictions imposed by governmental policy in Great Britain would appear to retard many applications; as, witness the borrowed developments which have recently been applied to the solution of both lighting and traction problems.

Mr. W. M. Mordey, in his presidential address before the Institution of Electrical Engineers, of Great Britain, quite recently, took this topic as the subject for some characteristic remarks. After careful compilation and considerable research, based upon the assumption that the value of any utility should be measured by the amount by which each unit of the population is served by such utility, Mr. Mordey finds that in no direction is the electrical engineering profession backward in England; in fact, it is ahead, and well ahead. He does not wish it to appear, however, that there are not restrictions and hindrances to the British engineer employing many valuable inventions which should reasonably and logically be developed in Great Britain. But the fact remains, says this doughty champion, that the aspersions which have been cast upon British engineering progress, and which have originated, unfortunately, in England itself, have no real foundation.

WATER RESOURCES INVESTIGATION.

The annual report of the director of the United States Geological Survey emphasizes the wisdom of determining the extent and character of the water resources of the country. Prominent engineers have long advocated the extension of government investigations of water resources, and it is a well-known fact that the work in the United States is not commensurate with that done in many European countries. If the United States were to provide for the prosecution of water resources investigations on a scale of thoroughness equal to that of Switzerland, for example, it would appropriate $11,000,000 annually, a sum 110 times greater than the present annual appropriation for similar work in this country.

Aside from the development of power, which would be a contemporary advantage, together with irrigation, increased facility for inland-waterway navigation, and the canalization of streams not now available for water transportation, the saving of waste caused by floods would be considerable. It is estimated that the annual damage caused by floods in the United States must be at least $100,000,000, and it is stated that in many parts of the country the proper expenditure of an amount equal to one year's flood loss would prevent further floods. In other parts of the country the cost would probably equal the losses of two or more years, but in every locality prevention could be accomplished by an expenditure equivalent to the losses from the floods of a few years.

Whatever means may be finally adopted to prevent the devastation by floods and to conserve the power resources and the possibilities of waterway transportation, the data must be gathered largely by government surveyors. It is quite necessary, then, that the Geological Survey, or whatever department of the Government may undertake this work, be aided by such appropriations as will enable the speedy and thorough compilation of the data now so ardently desired by constructing and contracting engineers.

The Mexican Light and Power Company.

A controversy has arisen over the Mexican Light and Power Company, certain directors of the Bank of Montreal being arrayed on one side, and Dr. F. S. Pearson, of New York, with certain Montreal and London associates, on the other.

The company was formed under the corporation laws of the Dominion of Canada, in 1902, by Dr. Pearson, to develop waterpowers on the Necaxa River, ninety miles from the city of Mexico. The bonds outstanding amount to $12,000,000, and there is $13,000,000 stock. A very successful power demand has been built up, and current has been satisfactorily transmitted to a number of mining camps and to the City of Mexico, where the company controls the electric-lighting facilities.

Some time ago Dr. Pearson succeeded in securing control of the Mexican Tramways Company, and later sought to arrive at equitable terms for the acquisition by the tramways company of the Mexican Light and Power Company. Some of the directors of the company, headed by President E. S. Clousten, managing director of the Bank of Montreal, opposed Dr. Pearson's proposals.

A special meeting will be held in Montreal on December 30 to consider a lease of the Mexican Light and Power Company to the Mexican Tramways Company, Dr. Pearson and his associates representing more than the twenty-five per cent of the stock which is necessary to issue a call for a special meeting.

The tramway company seeks a lease of the Mexican Light and Power Company on the basis of the payment of fixed charges, seven per cent on the preferred stock, and four per cent on the common stock. The directors of the light and power company say that the earnings of that company are now at the rate of seven per cent on the common stock, and that the earnings of the tramways company are at the rate of less than two-and-one-half per cent on that company's $6,000,000 of stock.

Formal Opening of Patapsco River Plant

On November 28 the Patapsco River plant of the Patapsco Electric and Manufacturing Company, Baltimore, Md., was opened with formal ceremonies. The Patapsco River plant, it will be recalled, was constructed about a year ago, and in the technical journals at that time was given particular attention, as the development is unique in combining in one structure both power house and dam, the turbo-generators being located within the concrete abutment.

The plant has now been running for some time, but owing to numerous changes which were found necessary, especially the rebuilding of the power tunnel to make it air and water tight against floods, continuous operation did not begin until three months ago. The formal public opening was held after all was assured to be in complete working order. Five hundred visitors were present November 28 upon the invitation of the power company and witnessed the starting up of the plant by the young daughter of Victor G. Bloede, president of the company. Following the ceremonies, a luncheon, cooked by electricity derived from the waterpower, was served to the guests.

The completed plant cost $175,000. The dam and power house creates a head of twenty-six feet, and contains two 300-kilowatt alternators, generating at the transmission potential of 11,000 volts for distribution to Ilchester, Ellicott City, Catonsville and Southwest Baltimore.

Electrical Engineers Entertained by the National Commercial Gas Association.

In connection with the Gas Appliance Exposition, which was conducted, under the auspices of the National Commercial Gas Association and the American Gas Institute, from December 7 to December 12, at the First Regiment Armory, Chicago, Ill., a spirit of the greatest cordiality was effected by reason of the co-operation of the Chicago Section of the Illuminating Engineering Society and the officers and members of the National Commercial Gas Association.

On the evening of Thursday, December 10, the Chicago Section of the Illuminating Engineering Society was entertained at a banquet at the Auditorium Hotel, tendered by the National association, and later in the evening the Section was the guest of the Gas Appliance Exposition, being welcomed by A. Cressy Morrison, who made a brief address commendatory of the activity of electrical engineers in bringing to the fore the advantages of better illumination.

Mr. Morrison brought to the attention of the illuminating engineers some interesting figures concerning the extent of the gas industry. The investment in the United States today amounts to $1,600,000,000. Gas is supplied to 38,500,000 consumers, and of this number there is one gas meter to every seven people. The output for the year at the present time is about 200,000,000,000 cubic feet.

Indiana Public Utilities Bill.

At the second annual convention of the Indiana Manufacturers' and Shippers' Association, held at Indianapolis, Ind., on December 10 and 11, the principal business was the consideration of a public utilities bill to be introduced in the next session of the Legislature. A number of public-utilities men were present.

The bill advocated by the association is sweeping in its provisions, and seeks to include waterworks, telephone and telegraph, electric light and power, and transportation companies of every description, and is patterned largely after the Wisconsin law. Exception was taken to the advisability of framing such a bill for Indiana, and it was contended that transportation utilities have already been brought well under state control. A legislative committee was appointed to prepare a bill providing for a public-utilities commission, and present it to the Legislature for passage. The following men were chosen: C. C. Perry, Indianapolis Light and Heat Company; L. C. Boyd, Indianapolis Water Company; C. H. Graf, Indianapolis Gas Company; T. P. Sylvan, Central Union Telephone Company; Charles H. Norton, Indianapolis Telephone Company; J. R. Zartman, secretary of the Indiana Manufacturers' and Shippers' Association; C. M. Kimbrough, Muncie, a bridge manufacturer; M. D. Wilson, Madison, cotton-mill owner; and C. C. Foster, lumber dealer. S. S.

Wireless Conference Bill in the French Chamber.

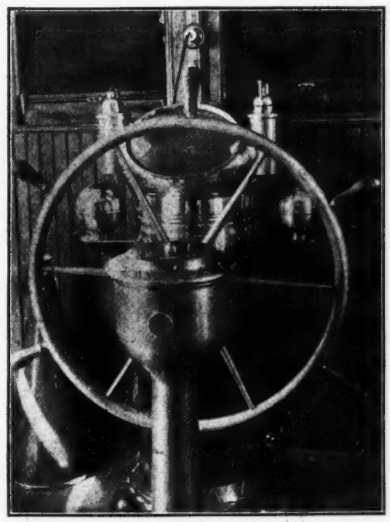
A bill for putting in force the decisions of the Berlin Wireless Telegraphy Conference of November, 1906, as embodied in an international convention, has been laid before the French Chamber. The conference has fixed wave-lengths, one of 300 metres, the other of 600 metres, for the transmission of public messages by the wireless current. All stations must be able to produce and to receive one, at all events, of these two wave-lengths. All public correspondence must be restricted to one of these wave-lengths. A coast station, however, can use other wave-lengths for long-distance communications, or for messages other than those transmitted by the public, provided that these wave-lengths are not under 600 metres and are not more than 1,600 metres. Stations on board ship must use the 300-metre wave-length. They are permitted, however, to use other wave-lengths as well, provided that these are under 600 metres. —*Nature (London), December 4.*

The Lighting and Power Arrangements and Other Uses of Electricity in a Modern Steamship.

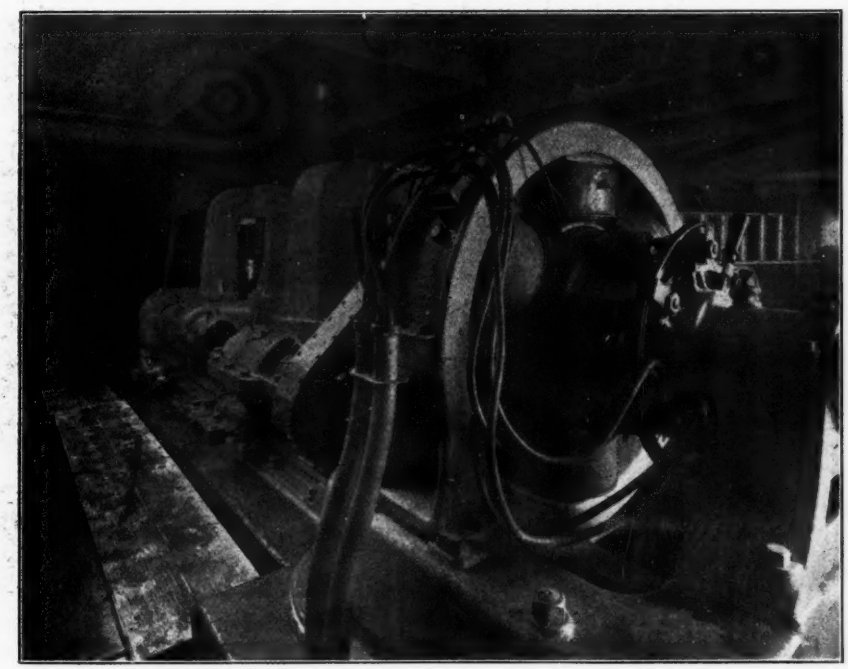
By Louis P. Zimmerman.

About the illumination, the lighting system and the size of the electrical equipment of a modern steamship, the average engineer knows very little. The giant steamship Minnesota which has been operated for some years between Seattle, Wash., and Oriental ports by the Great Northern Steamship Company, presents a very interesting problem in interior lighting adapted to the peculiar and special needs of a steamship. On shipboard every part of the equipment, particularly the generating units and the switchboards, is crowded into as small a space as possible, and at times this space is totally inadequate for the proper handling of the apparatus. This crowding is necessary, for a ship is a compact unit and every inch of space counts; hence the engineer is not allowed spacious quarters for the machines which form the electrical system.

The Minnesota is a combined passenger and freight-carrying vessel, 630 feet in length, 73.6 feet in beam and fifty-six feet deep from the keel to the saloon deck named from the bottom up: orlop, lower, 'tween, main and upper which is the weather deck. In the ship house are the promenade, bridge and boat decks with the navigating bridge above all. There are accommodations for 318 cabin passengers, 1,500 troop or steerage passengers and a crew of 230 men.



STEERING WHEEL, PILOT HOUSE.



MOTOR-DRIVEN STEERING GEAR.

amidships. There are five complete decks in the ship proper and three more in the ship house, giving a total depth of eighty-eight feet from the upper navigating bridge to the keel. These decks are

The total deadweight capacity is 23,000 tons of 2,240 pounds in addition to the weight of the stores and supplies, while a cubical capacity of 28,000 tons of forty cubic feet each is available for the storage of light cargo. The ship has complete double bottoms, each capable of floating the ship in event of damage and between which sufficient water ballast can be carried to obtain the desired stability in case of light loading. A longitudinal steel bulkhead extends the entire length from keel to main deck dividing the ship into two separate water-tight sections, and twelve transverse thwartship bulkheads give twenty-six water-tight compartments.

The 15,000-horsepower power plant driving the two twenty-foot twin screws and the 450-kilowatt lighting plant on board, would require a good-sized building and foundations of great depth and solidity on land, but here they are crowded together in the lower part of the hull supported on beams and almost regarded as a necessary incumbrance.

The boilers, sixteen in number, are of the Niclausse water-tube type, with a total heating surface of 39,264 square feet. The furnaces are coal-burning and have a storage bunker capacity of 4,000 tons with a reserve of 2,000 additional tons. The engines are in two complete units on the two sides of the vertical bulkhead. Each unit consists of three vertical, inverted, direct-connected, triple-expansion, Midvale Steel Company's marine engines with cylinder diameters of twenty-nine, fifty-one and eighty-nine inches and a common stroke of fifty-seven inches, designed to develop 4,800 horsepower per cylinder, running at seventy-eight revolutions per minute, with a steam pressure of 230 pounds. All the cylinders are jacketed with steel galvanized lagging and provided with a continuous circulation of live steam.

Two three-blade, true screw propellers with a pitch of twenty-two feet nine inches are driven separately through two shafts each 232 feet long. This immense power of the engines and propeller is transmitted to the frame of the ship through a cast-iron thrust shaft and bearing, eighteen-and-one-eighth inches in diameter and fourteen-feet-four-inches long, with nine collars two-and-one-half inches wide and twenty-seven-and-five-

eighths inches in diameter, running in an oil bath.

Next is the electrical plant and its many applications on board ship. Something over 450 kilowatts are developed for light and power in the little plant located in the forward part of the engine room on a platform at the level of the orlop deck extending across the width of the ship, three units being on each side of the bulkhead. Six single-acting, inverted, vertical, compound automatic Westinghouse engines direct-connected to six six-pole, direct-current, 110-volt generators, running at 300 revolutions per minute, generate the electricity needed. Each unit is closely surrounded by a protective iron railing and all connections are carefully insulated to avoid possible contact. The floor around the pedestals of the machines is of gridiron grates and steam pipes pass around and over the units leaving barely room for a man to pass through. Two switchboards, one for each set of three units, are located on the two sides of the dividing bulkhead and are provided with the necessary instruments, simply and compactly arranged. Power is distributed from these main boards on eleven lighting and seven power circuits to various smaller boards in other parts of the ship. The three-wire system is used throughout for power and light. The total installed motor capacity is 1,566 horsepower.

A brief mention of the various uses of power in the ship is almost necessary to get an idea of the extent of its use.

The ventilation consists of a fresh-air-supply and exhaust system. Fresh air taken in over the heating coils is delivered to the staterooms and saloons, seventy-two Westinghouse motor-driven exhaust fans being used in the entire ventilating system.

The steering gear is in duplicate, steam and electrically driven; the electrically-driven being used for landings and emergencies and the steam for regular work, both sources of power being directly connected to the steering quadrant.

The refrigerating plant consists of two brine refrigerating machines, two air coolers, an ice-making machine, and water cooler for filtering drinking water. Two seventy-five-horsepower motors are direct-connected to the two thirty-ton marine ammonia compressors.

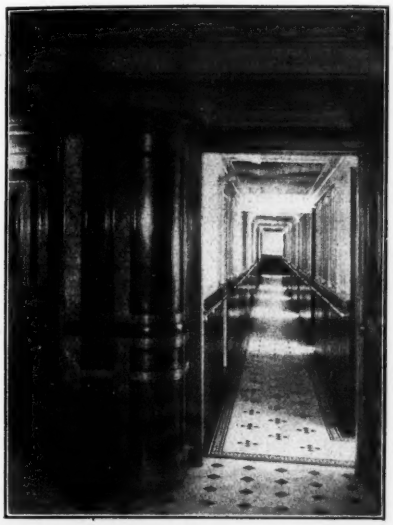
Electrically-operated winches are installed throughout. There are in all thirty-eight cargo winches geared directly to General Electric series-wound, armored motors fitted with railway-type controllers, as follows: Twenty-six twenty-five-horsepower, capacity of 3,000 pounds; eight 40-horsepower of 5,000 pounds; one 7,000 pounds; two 10,000 pounds and one 14,000 pounds.

Interior communication in the Minnesota is the same as in a first-class hotel, being complete with telephone system, call-bells, fire-alarms, electric whistle con-

WESTINGHOUSE GENERATOR, FOR POWER AND LIGHTING SERVICE.

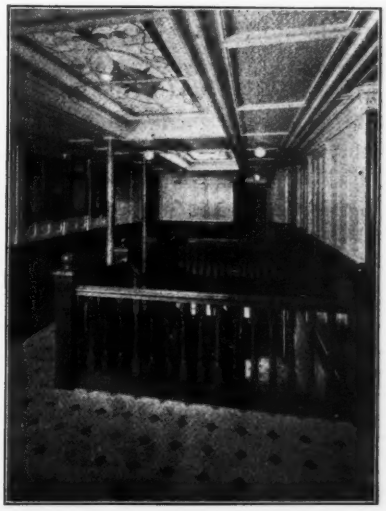
trol, electric cooking and electrically operated dumb waiters.

Passenger accommodations on board are entirely dependent for heating on electric heaters, there being apparently nothing else to satisfactorily take their place.



CABIN HALLWAY, PROMENADE DECK.

CENTRAL TELEPHONE STATION.



MAIN STAIRCASE, BRIDGE DECK.

Electric heaters are an unprecedented departure from ordinary heating practice, but are superior on shipboard to steam radiators because they occupy less room, are more easily regulated and not liable to tip over. One electric heater is found in each stateroom.

Modern vessels demand the use of electricity for lighting. The incandescent lamp is no small factor in bringing out the harmonious effects of the interior furnishing of the Minnesota. Luxurious finishings and superb furnishings would appear like dismal caverns were it not for the art of the electrical engineer in illuminating and beautifying the interior. In the staterooms, saloons, library, smoking room and passenger quarters, special ornamental fixtures are installed, and the design and finish of these fixtures harmonize with the interior furnishings.

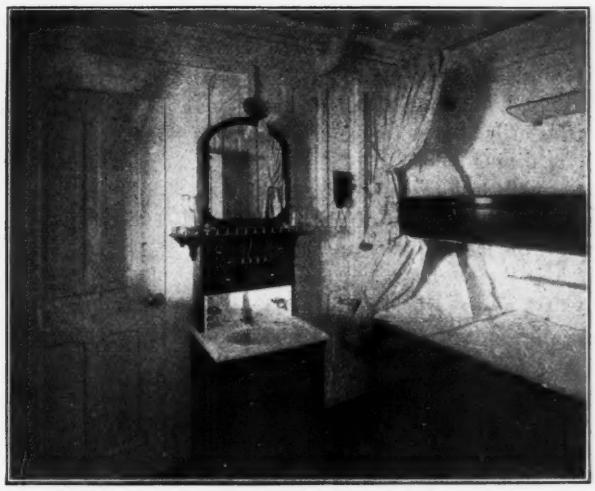
In the steerage, engine rooms, firerooms, cargo holds, on the decks and all other places where there is any moisture or exposure to weather, fixtures with a steam tight globe and heavy protection guard are installed.

The Minnesota is equipped with a twenty-four-inch General Electric searchlight on the pilot house which projects a beam of light of sufficient density to render plainly visible on a dark, clear night a light-colored object ten feet by twenty feet at a distance of about 5,000 yards. A searchlight is a necessity on board ship, and its importance and usefulness are demonstrated in picking up buoys in channels, signaling between ships at sea and in making landings in the dark.

All parts of the Minnesota are open to the public and the quarters occupied by the officers are luxuriantly finished. The pilot house is finished in wainscoting of dark stained cherry with an upper paneling of quartered oak. The chart room and captain's sitting room are done in cherry and oak with dark upholstery.

The public are interested mainly in the passenger accommodations, and these will now be described in detail. The main dining saloon in the forward end of the mainhouse on the upper deck extends the full width of the house. The walls are finished in dark, rich mahogany side paneling with rectangular windows in the front and side of the saloon, fitted with

DESK IN LADIES' MUSIC ROOM—PORTABLE LAMP AND PENDENT INCANDESCENTS.



STATEROOM, PROMENADE DECK—NOTE TELEPHONE, MIRROR AND BERTH LIGHTS.

mahogany sliding shutters and stained glass panes topped with Adams-Westlake ventilators. The ceiling design is stucco work of cream and gold; the ceiling and beam cappings are staff paneling; the electric fixtures and exhaust vents are in alternate panels. The furniture is all mahogany, finished in old gold and draperies. There is a seating capacity for 190. The whole scheme of lighting the dining saloon is to give it a rich, pleasant appearance to set off the white dishes and tables, the silverware and the various viands. This plan is followed out in the dark, rich mahogany background and furniture, and the dark carpet on the floor. The tables are illuminated by lamps covered with frosted globes which give a diffused light on the tables, the ceiling and the faces of the diners, producing an abundance of light, but entirely eliminating any glare or direct exposure to bare lamps. The forty lamps in the ceiling arranged in alternate rows, give a rich, full coloring to the entire room.

From the saloon a grand double staircase of mahogany with a curved baluster leads to the social hall and the staterooms on the promenade deck. This hall is built around the double staircase leading to the dining saloon and up to the upper deck. Special twisted posts and a pleasing curve make the banister fit in well with the symmetry of the room. Directly above the staircase is a stained-glass skylight surrounded by white scroll work and rectangular capped beams between which are six ceiling lamps covered with large frosted globes set deep into an ornamental rosette, illuminating the hall evenly and satisfactorily, but not nearly as intensely as the dining saloon.

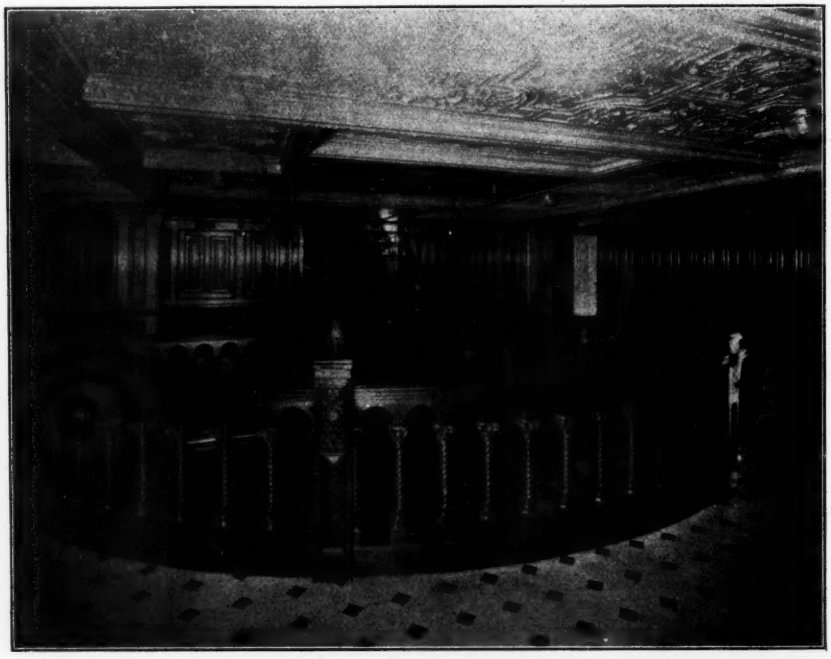
Above the saloon and off from this hall on the starboard side of the promenade deck, is the ladies' parlor and music room, which is the most comfortable and inviting part of the whole ship. The furniture, the writing tables and the grand piano give the room a desirable homelike appearance. The color scheme is sky-blue and silver, the walls are paneled with bird's-eye maple and the ceiling is of tinted staff finished throughout in light gold furnishings. A light olive-green upholstery, light draperies and stained-glass windows all suggest cheer and comfort. All tables have drop lamps with heavy ornamental shades throwing the light directly on the table for reading or writing. In the ceiling some eight-candlepower bare lamps, set in long slender rosettes, give a gentle white light to the room as a whole, but are not sufficient in number or power to cause annoyance or distress to the eyes. There are no pronounced shades or colors, all being a uniform, cozy, harmonious silver and white.

In the adjoining library is an entirely different style, all the paneling being of dark oak, and all the tables and furniture of dark upholstered leather. The color scheme is buff and gold artistically worked out in stucco conveying a sense of grandeur, quiet and impressiveness. A two-fold lighting scheme is carried out. The room as a whole is lighted with a few ceiling lamps covered with frosted globes, set well down with a long rosette arranged in the centers of octagonal designs between the transverse ceiling beams. Bare lamps, set two and two, on either side of the central columns, just above the tables, provide light for reading. While sufficient, the illumination is hardly the best for a library, being too high and too much diffused.

The smoking room, on the after-end of the bridge deck, has panelings of Flemish oak, natural finish, and rosewood wainscoting, harmonizing with the rosewood furniture, upholstered in red leather. In the center of the ceiling, which is worked out in stucco and light oak, paneled and capped, is a large raised skylight of colored glass. Directly above the glass is a fan to draw off the smoke. All the lamps are bare, placed in the ceiling, and of sufficient number to well light the interior, which reflects on the reddish colored furniture, and gives that brilliant, festive effect common to smoking apartments.

The long halls leading through the ship are fairly well and sufficiently lighted with lamps enclosed in frosted-glass globes set in the ceilings, spaced about twenty-five feet apart. The lower halls are uniformly dark, the upper part white, and all are provided with a convenient handrail.

The staterooms are finished in white enamel, with mahogany and oak fittings. All are outside rooms, provided with a window, sliding blinds, stained glass and a hinged ventilator open at the top. Each room is electrically lighted with two bare lamps. Electric reading lamps, placed above each berth, under the control of the occupant, are so arranged that it will not disturb the other berth. All the second and third class rooms are well lighted by artificial light, but some, of course, are inside rooms, and daylight is impossible to get.



SOCIAL HALL AND MAIN STAIRCASE—PROMENADE DECK—HEMISPHERES AND INCANDESCENT LAMPS.

On deck, and below in the engine rooms, the boiler rooms and the holds, bare incandescents are arranged for special work wherever needed.

As a whole, the lighting is better planned and carried out with more care than in a majority of offices and residences. The 1,300 lamps distributed over eight decks of the immense ship give, roughly, one lamp per 150 square feet, and sufficient and satisfactory illumination in all parts.

NEW YORK SECTION, ILLUMINATING ENGINEERING SOCIETY.

DR. STEINMETZ ON "LIGHT AND ILLUMINATION."

The meeting of the New York Section of the Illuminating Engineering Society, held in the Engineering Societies Building on December 11, was very well attended, as might have been expected, owing to the fact that the speaker of the evening was Dr. C. P. Steinmetz.

When the section chairman, W. W. Freeman, called the meeting to order some seventy-five members were present and, from the attention given the speaker, it may be said that they not only enjoyed, but also profited by the lecture. Dr. Steinmetz selected a very broad topic, "Illumination and Illuminating Engineering," and treated it in like manner. He stated that the physiological aspects of the subject were much more important than the physical ones, owing principally to the effect upon the eye of both direct and reflected light and the lack of it in many ways.

Calculations.—As far as calculations were concerned, the importance of using the lumen as the unit of efficiency, as well as flux, was brought out, as, owing to the varying characteristics of our sources and also because the tube lamps, such as the Moore and Cooper Hewitt, have no candlepower values which are of any importance. Besides, the lumen has a definite relation to the intensity on the illuminated plane, or, in other words, the flux density.

Although we may determine accurately, by means of illuminometers, the intensity in foot-candles or flux density, this physical quantity will not be of great value unless we have fulfilled the physiological requirements.

That there are many factors in illumination problems which bear directly upon the use of our eyes, was very forcibly presented by the speaker. For instance, high intrinsic brilliancy will lower the visual sensibility, even though the lamps are not directly in the field of vision; either too high or too low flux density causes considerable strain. Complete uniformity is also undesirable, as the eye will have no opportunity to rest. On the other hand, the change from high to low intensity must be within comparatively small limits, for although the eye can withstand great changes in this respect, they must not be rapid ones. We can see fairly well at night under a full moon, when the flux density will be but a fraction of one foot-candle, and also under full sunlight at noon, when the flux density will be several thousand times that amount, but we cannot go from a dim room into clear sunlight without decided eye strains.

Color.—As far as color was concerned, Dr. Steinmetz did not refer to the effect of ultra-violet rays, but it is obvious that this troublesome feature will be eliminated when we use shades which cut down the intrinsic brilliancy.

When light sources of various colors are desired, this can be accomplished by means of colored shades, and in this connection he called attention to the fact that color differences vary rapidly under various intensities.

Shadows.—Probably the most interesting feature of the lecture was the importance, clearly shown, of the use of shadows, and it would seem as if the crux of the matter was in the success with which this feature was carried out. In very few cases no shadows are desirable, a drafting board being one of them; but in the majority of cases we need shadows without sharp edges, and this can be accomplished by means of a combination of diffused and direct lighting.

In domestic lighting, the diffusion can usually be obtained by means of reflection from walls and ceilings. The fact that we require at least some of the light within the line of vision, can be readily demonstrated by a visit to an auditorium where only indirect lighting is employed. Dr. Steinmetz summarized the defects in our present systems as follows:

1. Improper combinations of high and low flux density.
2. Sources of high intrinsic brilliancy in the field of vision.
3. Improper combinations of direct and indirect lighting.
4. Not enough shadows.
5. Shadows with very sharp edges.

He seemed to think that many of the difficulties could be overcome if we studied the effects of daylight in the various rooms of a house.

Street Lighting.—Dr. Steinmetz stated that uniform intensity was the chief desideratum, but on account of economy it would necessarily have to be of low intensity. In order to obtain these results the light source, if placed within twenty feet of the ground, should give its maximum intensity about ten degrees below the horizontal and to be as near white as possible in color, owing to the poor refraction from roads and buildings. The objection to this method was that shadows from an object are very long and therefore objectionable, as the appearance of the object is distorted. Another objection is that a source such as he described would be of too high intrinsic brilliancy, and if diffusing globes were used the light near the horizontal would be considerably reduced. Therefore the solution of the matter was to place the lamps forty or fifty feet high and use enough of them to obtain uniform illumination.

In answer to a question he stated that the system in Detroit had not been successful, as it was altogether too pretentious and not enough lamps had been used.

In answer to the many criticisms which have been made of the lighting in this country as compared with Europe, he stated that the conditions here are entirely different, and cited as an example the fact that the city of Schenectady with only 70,000 population covers the same area as the city in Germany where he was born, which has a population of 450,000.

Dr. Steinmetz called attention to the fact that, although we could not afford to light our streets by placing the units very high as suggested, we could afford to do it in exposition work, and he hoped that general illumination would be provided in this manner at one of the expositions to be held in the future.

At the January meeting two papers on street lighting will be presented, one by W. C. Allen, electrical engineer for the District of Columbia, and one by S. S. Rhodes, of the New York Edison Company.

Enlarged Power for Interstate Commerce Commission.

An entering wedge to enlarging the jurisdiction of the Interstate Commerce Commission is contained in a bill introduced in the Senate by Senator Burkett of Nebraska. It places the telephone companies, electric-light companies, and the gas companies in the District of Columbia under control of the Commission.

As telephone companies do an interstate business, should the bill become law, such telephone companies may also be placed under jurisdiction of the Commission.

Rome has appropriated about $4,000,000 for an electric plant, the generating apparatus for which will be placed twenty-two-and-one-half miles distant.

The New York, New Haven & Hartford Railroad Electrification.

Two-Hundred-and-Thirty-second Meeting of the American Institute of Electrical Engineers, New York, December 11.

The two-hundred-and-thirty-second meeting of the American Institute of Electrical Engineers was held in the Engineering Societies Building, New York city, on Friday evening, December 11. Secretary Ralph W. Pope announced that eighty-eight associates had been elected to membership and that John Knowlton Robinson, of New York and South America, had been transferred to full membership.

President Louis A. Ferguson called the meeting to order and introduced W. S. Murray, electrical engineer of the New York, New Haven & Hartford Railroad, who presented the paper of the evening, an abstract of which follows:

THE LOG OF THE NEW HAVEN ELECTRIFICATION.

BY W. S. MURRAY.

Unlike steam traction, where the number of links in the delay chain is but one, electric traction has its delay chain composed of three links; namely, the power house, line, and locomotive. A failure in any one of these links may produce train delay or delays.

In the conception of the form of power house, line, and locomotive to be used in the New Haven system, ignorance and lack of experience led those pertinently interested in its success to believe that while the chain of power generation, and its transmission and utilization for traction, was of a new character, that its links, however, were made up of principles long recognized and reliable. They were right in this conclusion, except that it did not include certain phenomena which could not have been anticipated, due to the combination of these old principles in the form of this new chain.

THE SERIOUS FAULTS.

Power House.—The electric power supply for the New Haven road is derived from four 11,000-volt steam turbine generators, three of which have an electric capacity of 3,750 kilovolt-amperes single-phase; the fourth unit consisting of a 6,000 kilovolt-ampere, three-phase generator, which can also supply single-phase current to the system.

Although the generators as originally designed were made exceptionally strong, and particular attention paid to their insulation, due to the necessity of grounding one phase, it was found that the utilization of so much single-phase current from a three-phase star-wound generator produced a stray magnetic field completely out of the path of normal lamination. As a result it was impossible to develop for continued operation more than sixty-six per cent of the normal rating of the generators. Overloads of any character produced abnormally rapid heating, making such operation dangerous, although the generators were guaranteed to carry 50 per cent overload for two hours, and 100 per cent overload for two minutes in order to meet the sudden drafts of currents required for a schedule such as exists on the New Haven road. The generators are today operating in the power house, fulfilling the guarantees mentioned previously.

Line Insulation.—Of the effect of steam locomotive discharges upon insulators, there was no initiative by which to be guided, and it became necessary to decide upon the factors of insulation that would be required. It was quickly noted that the greatest number of insulator failures occurred wherever the insulation was subject to the direct blast of the steam locomotive. To correct the difficulty, therefore, it was found necessary to double up on anchor insulators. The intermediate messenger insulators proved adequate and it was not found necessary to increase the impregnated stick insulation between trolley wires at curves, but wood stick insulators had to be added in series with the molded material insulator between the pull-off wire and pull-off post. The original insulators on the anchor-bridge switches were made of molded material and for them was substituted porcelain. It was not necessary to change the feeder insulators on the catenary bridge struts. While very little trouble has been experienced with the form of insulation used for supporting the feeders under highway bridges, it is anticipated that trouble will follow if this is not changed. The present form consists of the corrugated spool-type insulator, for which there will be substituted a regular porcelain double-petticoat insulator.

Today, instead of line failures being the rule, they have become the exception.

Circuit-breakers.—The momentary energy involved in a short-circuit produced upon a line fed by high power, high-speed turbines is very great. Under the sub-title "Power House" it was stated that the generators were operating under their guaranteed capacities. Internal heating, due to stray magnetic field, was the cause of the generators failing to meet their designed capacity. This heating was completely cured by the simple addition of a short-circuited winding surrounding the rotating member of the generator, similar to that used in the well-known squirrel-cage type of induction-motor rotors. It is interesting to note here, however, that while the heating is entirely eliminated by this short-circuited winding, its effect on the occasion of a short-circuit is to allow more current to flow.

The failure of circuit-breakers, either in the power house or on the line, naturally produced train delays of large or small magnitude. It was difficult to believe that these large circuit-breakers were incapable of taking care of the short-circuits, and some time was wasted in thinking this way. Therefore, we reluctantly but surely arrived at the conclusion that the conditions would have to be changed.

The remedy was simple. Instead of feeding the main line with a direct transmission straight from the power house bus-bars to the trolleys directly opposite the power house, the current was fed into the line over feeders connected to it at Port Chester and Stamford. For the feeder resistance, above described, there has since been substituted impedance coils installed in the leads of the generators.

Trolley Wire.—An examination of the hard-drawn copper trolley wire throughout its length proved that even after only a few months' operation upon it, its cross-section had been so materially reduced as to point to its short life with a continuance of operation upon it. Especially was this true in the vicinity of the many low highway bridges where the trolley wire approaches the bridge on a two per cent gradient. This fault and dilemma were indeed serious. The cause of the difficulty was perfectly apparent; namely, the hard spots in the line which existed at the hanger points.

Many suggestions were offered. None of them, however, offered the speedy installation that was paramount. Mr. McHenry, vice-president of the New York, New Haven & Hartford Railroad Company, made the suggestion that an auxiliary wire be suspended from the present copper wire by clips at its midpoint between the hangers, and followed up the suggestion that this auxiliary wire be made of steel, of the same cross-section as the 0000 grooved hard-drawn copper above it. It took two weeks for the manufacturer to draw two miles of this wire. It was installed immediately upon its receipt on the main line between Port Chester and Harrison. On the night of its completed erection a special seven-car train with two locomotives was operated upon it for several hours. Previously to the installation of the steel wire there had been installed a section of hard alloyed wire suspended in a manner similar to that of the steel. It is undeniably true that hard alloyed wire would, from a purely operative point of view, be the better of the two, and yet the commercial aspect, which would naturally include its cost, had to be considered, particularly in reference to so large an immediate order as one involving 100 miles of single-phase

electric trackage. Again it is important to note that the steel, besides having the advantage of being a cheaper, harder, and stiffer wire, also possesses a lower coefficient of expansion and higher elastic limit, especially valuable characteristics for the service desired. The auxiliary wire construction on the main line, as described, prevails throughout the whole system, except at the approaches of and under a few very low highway bridges, where the contact system consists of two wires strung in the same horizontal plane.

The New Haven trains have been operating now on the auxiliary wire for several months, and absolutely no kinking has been noted at the hanger points, with the attendant result of a smooth and almost sparkless overhead contact.

Locomotives.—There were originally purchased thirty-five locomotives, which was considered an adequate number to take care of the New Haven passenger service. These locomotives, considered *per se,* were rated on a half-unit basis. That is to say, the half unit was designed to handle about seventy-five per cent of our trains, the remaining twenty-five per cent to be handled by two units. Only a short experience in commerical operation revealed two important facts. The first one of a very encouraging nature, the second, decidedly otherwise. The first was the proof that the two main parts of the locomotive, namely, the transformer and motors, had sufficient capacity to more than handle the manufacturer's guarantees. The second was the discovery that many of the auxiliary electrical and mechanical parts of the locomotive equipment were not of equivalent capacity. It was simultaneously apparent that more locomotives would be required to provide for an increase of train service and the reduction of time schedule, and an order was promptly placed for six additional ones; before accepting their design, however, a careful survey was made of all the component parts of the locomotives at hand, in order to determine the changes necessary to be incorporated in the six new engines. To accomplish this it was found necessary to make a number of electrical and mechanical changes.

The most important electrical changes made were in the switch-groups and brush-holders of the motors. The former lacked carrying capacity and the latter sufficient insulation. To these shortcomings were due the greatest number of our first train delays. The most important mechanical changes necessary were the reinforcement of the truck bolsters and installation of pony wheels, respectively, for locomotive with and without pony wheels.

With the exception of the installation of pony trucks, the six new electric locomotives arrived within five months of the date of their order. To be noted here is the marked value of the spring type of armature and field suspension begun with the New Haven locomotive motors, thus making flexible the entire motor suspension.

It seems to be the time and place, here, to draw attention to a point in design concerning the New Haven locomotives that has been so persistently misrepresented by those who seem to have been ignorant of the facts. The specifications upon which the locomotive units were purchased, as stated hereafter, were that each unit would handle a normal trailing load of 200 tons. The writer, by careful measurement of the weights of all the trains (trailing loads) in the New Haven service, found that they averaged 212 tons. It seemed good engineering that if seventy-five per cent of the service could be handled by locomotives rated upon a basis of 200 tons trailing load, that that would be the correct locomotive unit size; using two units for the remaining twenty-five per cent of the trains. Today, three years after this decision, we find that seventy-three per cent of our trains can be handled with single units, twenty-seven per cent requiring two units. The percentage is slightly different from the original, as the service is slightly heavier.

THE MINOR FAULTS.

Generator Burn-outs.—Previously to the rearrangement of the feeders or the installation of the choke-coils in the power station, the short-circuits that were experienced on the line naturally had a deleterious effect on the generators. The prodigious rush of current naturally produced severe strains in the armature windings, strains whose mechanical intensity was made manifest by the movements of the coils. Therefore, during this period of violent short-circuits, frequently the generator coils were grounded and burned out. Since the rearrangement of feeders or the installation of choke-coils, the violent short-circuits have disappeared and with them the damaging effects on the generators.

Hard Spots in Line.—The original main-line section-break consisted of a rectangular impregnated wood frame suspended under the anchor bridges. The trolley wires were carried on opposite sides of this rectangle lapping, of course, a sufficient distance in the center so as to permit a short period of simultaneous contact of the shoe with both trolleys, thus preserving continuity of current to the locomotive in passing from one section to another. It was found that these rectangular section breaks were prone to get out of shape, introducing a very rough spot in the line, its effect being, on the passage of the shoe, to draw long arcs which frequently extended themselves to ground. Our new section break, containing all the flexibility obtained by the auxiliary wire, has been constructed by simply staggering the messenger insulators of each trolley sixteen inches, thus permitting the anchor-bridge trolley wires of the same track to pass at this distance. Each trolley wire is dead-ended to a wood impregnated stick insulator, supported by the messenger of its opposite section. By this arrangement practically all inertia is taken out of the section break and a sparkless passage between sections is obtained.

Signal Wires.—The catenary bridge struts carrying the cross-arms for the by-pass or feeder wires, likewise carry the cross-arms upon which are installed the signal wires. The voltage placed on these signal wires is entirely distinct from the propulsion voltage, it being 2,200 volts and sixty cycles. The proximity of the wires of these two systems has been the cause of short-circuits between them, resulting in double failures. It would seem that as the signal system should be so completely separated from the propulsion system, it should be installed on an entirely separate pole line. If, however, right-of-way conditions make it absolutely necessary that the supporting structures of the catenary system should support also the signal wires, then the two circuits should be made as distinctive as possible, the propulsion system having its wires on the cross-arms on the railroad side of the struts, the signal wires being installed on the opposite.

Locomotive Current Collectors.—An efficient pantagraph shoe has proved itself a very difficult problem. The present cost is about 0.06 of a cent a locomotive-mile. We have made various experiments with aluminum, phono, copper, and steel rigid and spring-supported pantagraph shoes. While this feature does not present a serious aspect, it is none the less a most interesting study. Shoe life is also seriously affected by the amount of soot deposited by the locomotives upon the overhead wire. While we have obtained mileages varying between 600 and 1,500 miles per shoe with various types used, other roads of lesser speed and not subject to the effect of locomotive stack discharges, have obtained as high as 25,000 shoe-miles.

THE LOG OF OPERATION.

Electric Passenger Service.—So great was the demand for electric service that in July, 1907, long before we were ready, as the records of our operation have proved, the first commercial service was begun between New Rochelle and the Grand Central Station. With all speed possible the electrification was pushed eastward and local service was established from Port Chester in August, 1907. Local service from Stamford followed in October, and finally, on July 1, 1908, all through and local passenger trains were under electric schedule between Stamford and the Grand Central Station.

Individual and Collective Train-minute Delays in Electric Zone, Due to Failures in Power House, Line, and Locomotive.—The segregation of these failures based upon train-minute delays offers a quick and interesting comparison. It is to be noted that the last two months indicate a great improvement over the two preceding ones. From the chart have been taken the train-minute delays that have amounted to over 300 minutes per diem, which are treated separately in the following para-

graph. It is interesting in reviewing the "cause of delay" to note that ninety per cent of the causes are of an inconsequent nature, and might be reasonably expected when considered in the light of an initiative service.

Serious Failures in System Causing Over 300-minute Delays.—A description of the cause of one applies to all of them, except those of July 16 and October 19. In every instance, excepting the two dates mentioned, the tie-up was due to simultaneous failure of several circuit-breakers, due to a short-circuit, thus temporarily disorganizing the distributing system, preventing the electrification of trolley wires.

On July 16, the White Mountain Express left the rails just east of Greenwich station, tying up both east-bound tracks, and causing excessive train-minute delays. Except for the electric rail bonds which suffered destruction, no other electrical apparatus was disturbed. One of the electric locomotives attached to this train was immediately returned to service, the other following it the next day after light repairs were made to its pilot and third-rail shoe mechanism.

On October 19, although the impedance coils in the generator station were in action, a ground occurring on the bus-bars of the anchor bridge directly outside of the power station, in combination with a defective circuit-breaker, produced a short-circuit which destroyed the operating mechanism of the breaker in question. This unfortunately occurred at a time when temporary connections had been made between the power house and line; on this account a serious delay was experienced in restoring the voltage to the line.

It is interesting to note that since the complete inauguration of electric service, the serious failures in the system have been reduced from five to one.

The Capacity of the Electric Locomotive.—The capacity of the electric locomotives was based upon their ability to handle a trailing load of 200 tons in local service with stops averaging those that exist between stations between New York and New Haven. As a matter of fact, the station stops between Stamford and New York average very much greater than between New Haven and New York, and as very quick turns are made at both termini, the service may be said to be more severe under these conditions than under the guaranteed conditions of purchase.

Comparative Steam and Electric Engine Mileage.—In obtaining an average for all electric locomotives of 212 miles, it is to be remembered that this was made for all classes of service, express, express-local, and local, and further that the mileages were made over three short terminal runs; namely, Stamford, Port Chester, and New Rochelle to New York, the distances being approximately thirty-four, twenty-six, and seventeen miles, respectively. Several engines made eight runs, two of them nine, and one ten. It is difficult to get an exact comparison for steam locomotive mileages. All of the electric engines are confined to one division, while the steam locomotives do interdivision service. However, using the records of the 1906 steam service for Labor Day and considering steam locomotives doing mileage in and out of the present electric zone, out of 117 locomotives the following record is to be noted: Ten made over 300 miles; twenty made between 200 and 300 miles; twenty-one made between 150 and 200 miles; thirty-four made between 100 and 150 miles; thirty-two made under 100 miles.

Thus with division limits double that of the present electric division, and with the additional advantage of interdivision runs, the electric mileage for this concrete case averaged thirty-four per cent better than the steam mileage.

THE ELECTRIFICATION IN ITS RELATION TO MATTERS OTHER THAN TRACTION.

Telegraph and Telephone.—Single-phase electrification affects telegraph and telephone systems whose wires lie parallel with and in close proximity to the railroad. The corrective for this disturbance has proved to be simple and not costly. Briefly described, it consists of compensating transformers whose secondaries are a part of the telegraph and telephone wires and whose primaries receive their voltage from pilot wires strung on the same cross-arms as those bearing the telegraph and telephone wires, and thus having impressed upon them the same voltage, by electromagnetic induction, as the telegraph and telephone wires. The transformer secondary voltage is approximately equal and opposite to the induced voltage on the telegraph and telephone wires and thus constantly compensates for it throughout all ranges of induction due to the single-phase wires.

Public Safety.—As no fatality to the traveling public has happened by reason of the high-voltage wires since the system has been in operation, this would indicate the safety involved in its construction. The catenary form of construction as applied to the suspension of the trolley wire virtually eliminates all danger of these wires falling. On the other hand, the feeder or by-pass wires are not suspended by messengers, and although the 300-foot spans used in this construction are not uncommon, it has been considered a wiser policy to reinforce all such spans which are above passenger platform stations. It may be of interest to state also that the scheme of reinforcement is not to cradle or place supplementary wires in connection with this span, but simply use a steel wire with a large factor of safety reinforced by copper for conductivity conductor and supported from the struts by insulators. The resistance to ground of this construction will be far in excess of the ordinary insulator used in the open construction with the steel wire connected to it in such a manner as to make impossible the burning of this wire in two in the case of the insulator breaking down.

Foreign Wires.—All electrifications are subject to foreign wire crossings. As in the case of suspension of high-voltage wires over passenger platforms, instead of using supplementary catenaries or cradles, the safer (and incidentally the cheaper) method of crossing is to use at the crossing heavier (and possibly guyed) poles, better insulation, and larger wires than are commercially necessary in the other parts of the foreign transmission line. High factors of safety with economy are obtained following this policy.

COMMENTARY.

Lightning Protection.—An ideal arrangement of catenary construction in relation to lightning protection would be to have the overhead messenger system grounded, and from it suspended by insulators a secondary catenary system, to which in turn would be attached the contact wires. Even in the New Haven case, where the overhead messenger system is not grounded, lightning has given but slight trouble. This is probably due to the very great number of grounded steel trusses and struts projecting above the electrified wires.

Grounds.—Structures supporting high-voltage insulators should be grounded. Particularly is this true of structures foreign to the railroad company, such as highway bridges. This arrangement insures a prompt response of the circuit-breaker apparatus, and carries out the good practice universally applicable, that the material supporting the insulator be grounded. This principle has application in wood-car construction. Positive grounds between Pintsch gas pipes and both car trucks should be made to avoid any arcs being drawn under the car body.

Many of our catenary bridges, of both the intermediate and anchor type, serve to support signals. Signal men have been entirely free from coming in contact with the high-tension wires, by the simple provision of grounded close-mesh screens interposed between the signal platforms and the high-voltage wires. The value of two grounds can be rated considerably higher than twice that of one.

Tell-tales.—Tell-tales in connection with an overhead system offer a peculiarly difficult problem. It is quite apparent that the pantagraph current-collecting device would get into either electrical or mechanical difficulties with the present form of tell-tales. We have experimented at some length in trying to produce an electrical horn that would be automatically sounded by an approaching train. There is nothing particularly difficult in getting the automatic action or in producing a noise. The superiority of the tell-tale over the horn, however, is that no matter how much noise the freight train is making, the tell-tale always notifies, while in the case of the horn should the freight train be making more noise than it, the notification is lost. A horn if used for this service should be a large one.

Train Lighting and Heating.—On account of the necessity of wiring for electric heating and lighting some 2,500 coaches, it seems reasonable to retain the

present method and apparatus of heating and lighting the trains in the electric zone. To accomplish this it was only necessary to supply each electric locomotive with a small steam boiler used solely for train heating. The Pintsch gas system has been retained intact. Later, when the service is sufficiently extensive, all trains will be heated and lighted by electricity. All multiple-unit cars are to be heated and lighted by electricity.

Fatalities.—As has been pointed out, we have had several fatal accidents, due to men coming in contact with electrified wires. We are none the less concerned that in every instance they were men employed by the company. In each instance the accident was due to carelessness or violation of instructions, and most of the accidents occurred during the period of construction. The operating period has provided a less number of these unfortunate events, and the records today now seem to indicate that the future will be free from this most regrettable feature.

Cross-catenary Versus Bridge-bents.—The excellent results of a year's experience with cross-catenary construction in our Port Chester yard, where as many as ten tracks are spanned, is tempting encouragement for its application to main-line work.

Single Versus Double-catenary Construction.—Lack of operating data led the engineers of the New Haven road to take no chances with the overhead construction, and the double catenary was considered the safest.

Single-phase Operation.—The New Haven system provides that the volt manufactured in and leaving the doors of the power house, is the same physical volt that knocks at the doors of the locomotives. Thus the line is the single link that unites the power house and the locomotives. All such adjuncts as step-down transformers, synchronous converters, storage-batteries, and low-voltage distributing systems with their necessary attendant complement of help is dispensed with. The Cos Cob power house has the usual number of men for a station of its output, and the locomotives are operated by the electric locomotive engineer with the customary assistant present for emergency. This crew holds good for single or double-unit trains. An emergency repair train is the guardian of the line, attending to all matters pertaining to its repair and maintenance. Including the night and day crews of the emergency train the number of men employed to maintain the distribution system is nineteen. This covers about 100 miles of single track, including yards.

Conclusion.—In connection with the New Haven electrification I wish to speak of the privilege of association with E. H. McHenry and Calvert Townley. Upon Mr. Townley devolved the responsibility of decision as to the form of electrification selected. Neither the object nor the scope of this paper can include a description of the analytical course of procedure preparatory to the conclusion that the New Haven road would adopt the single-phase form of electrification. Suffice it to say that Mr. Townley's conviction to accept this responsibility was sufficiently strong to lay the foundation of this work. To E. H. McHenry, whose serious illness had prevented his filling the office of vice-president in charge of matters pertaining to engineering, fell upon accession to that office the responsibility of ratification or disagreement with the policy as set forth by Mr. Townley. That ratification is better written in the details of the electric zone itself, as in each department of power house, line, and locomotive may be seen the betterments due to his suggestion. To him is due the credit of the practical issue of this electrification.

This paper would, indeed, be incomplete did I not refer to the splendid courage and indomitable pluck of our contractors, who through a fire of criticism and business depression perseveringly stuck to their belief in the principles they were advocating. They can now have the satisfaction of viewing something begun and something finished; for while there may be many improvements to accrue to the alternating-current, single-phase system, the trunk-line principles have by them been laid and demonstrated.

After the reading of the paper Mr. Murray emphasized his belief in the single-phase, alternating-current system, and stated that it was with a good deal of pleasure that he saw among those present a number of noted engineers, who would undoubtedly contribute to the information available on this subject.

Mr. Ferguson said that the Institute owed to Mr. Murray an appreciation of the work he had done in thus frankly coming forward and stating the actual experience which he had had in the construction and operation of this untried and important undertaking. He called upon Calvert Townley, vice-president of the New York, New Haven & Hartford Railroad, who stated that he was strongly impressed by the radical way in which Mr. Murray had treated the subject. The nature and magnitude of the project under discussion emphasized the radical departure in Mr. Murray's methods. It was seldom that a man felt so sure that the beauties of the work which he had been doing would be so apparent that he could afford to call attention to only those points wherein he had failed initially, notwithstanding the fact that the ultimate working out had been eminently successful. Mr. Townley believed that now, five months after the complete substitution of electricity for steam, and while some of the improvements still have to be completed, the system has been demonstrated to be successful and well adapted to the service for which it was designed. It is an interesting fact that at the present time the electric service is less subject to delays and interruptions than was the steam service which it has replaced. The one radical thing that was done wrongly in the New Haven electrification, and which was really at the bottom of the major part of the difficulties that have been encountered, is that the electrification was not begun soon enough. Had more time been allowed for attention to minor details of equipment, and could work that had to be done under great pressure have taken its normal course, many of the troubles which can be traced to these facts would never have existed, and many of the defects which have caused delays to service would have been detected and remedied during the trying-out period instead of in practical service.

Mr. Townley took emphatic exception to Mr. Murray's expression that the company was not proud of the record made. Mr. Murray might say this in a spirit of great modesty, but Mr. Townley did not believe that any such statement was necessary. The company had reason to be, and was, proud of everything that had been done.

Mr. Townley endorsed what Mr. Murray had said in his paper concerning the Westinghouse Electric and Manufacturing Company, which was the contractor. This company's tireless, resourceful, prompt and cheerful co-operation with the engineers throughout the entire progress of the installation had contributed the essential features of its successful development, and the company was rightfully entitled to a full and frank acknowledgment. The keystone of the system was the locomotive. Without the single-phase, alternating-current motor the whole plan would become impossible.

In the locomotive a large part of the changes made were mechanical—not only mechanical changes to mechanical features, but also mechanical changes to electrical features. With the principal elements of the locomotive design, namely, the large gearless, twenty-five-cycle motors, there had been no trouble; their performance as to torque, commutation and capacity having been most gratifying. A feature of the locomotive design which Mr. Murray had passed over rather briefly was the flexible drive, whereby the armature of the gearless motor is wholly supported on and exerts its driving power through a set of spiral eccentric springs. Trackmen have frequently been appalled because electric locomotives are so much harder on

track than steam locomotives of even greater weight, and it has now come to be a generally accepted conclusion that this is due to increased impact, because the armature dead weight is supported without cushion rigidly on the axle. The impact due to this additional dead weight is astounding. In the New Haven locomotives the method of mounting the armatures, obtaining the cushioned effect, exerting the full driving power of the motors, and compensating for the so-called varying torque thereof has been successfully accomplished. The results in improved track maintenance cannot fail to be of far-reaching consequence.

W. J. Wilgus raised the question as to what extent the engineer was morally justified in seeking renown by a brilliant dash into untried ways at the expense of travelers who pay their fare with the expectation of reaching their destination as nearly on time as the most practicable state of the art of transportation will permit. It seemed to him that experimental application of electrical apparatus to untried conditions belongs to unimportant localities, where the results of failure would not be burdensome, and that only the most reliable, well-tried methods should be used where the results of failure might be embarrassing.

B. G. Lamme said that he had been more or less intimately connected with the problems in the New Haven electrification. There were two parts of the system to which he had given a great deal of personal attention. These were the design of the alternating-current generators in the power house and the design of the main motors on the locomotive. The popular opinion, even among engineers, when the decision as to the use of single-phase, alternating current was first announced was that the greatest trouble would be found in developing the large gearless single-phase motors, and that the designing of the generators would be comparatively easy. The record made by the gearless motors, particularly for commutator wear, and the demonstration of the absolute value and longevity of the preventive leads were remarkable. At the present rate of wear on the commutators of the locomotives now in service it would appear that there was at least fifteen to twenty years' life in each one of them, and there had been relatively little sparking, even when developing two or two-and-one-half times full-load torque.

In the designing of the generators it was discovered that although the reaction which caused the difficulty was known, it had not been tried out to an extent which developed its most harmful effects.

Mr. Lamme described the phenomena which occasioned the pulsating armature reaction, and said that when the first rotor was built the structure was laminated as completely as mechanical conditions would permit. Upon testing the first machine it was found that there was local heating with heavy load sufficient to create hot spots which practically broke down the insulation. After trying several remedies it was decided to attempt to eliminate all pulsating reactions from the armature by putting a short-circuit winding on the rotor of such value that a large current could flow in it with but little loss. In order to maintain this condition indefinitely without overheating, it was necessary only to put enough copper on the armature so that the C^2R losses under the short-circuit condition were within the temperature capacity of the windings. A complete cage winding was placed on one of the rotors of the New Haven generators. This rotor had not been designed originally for this purpose and it was therefore difficult to adopt the most suitable proportions in this winding. The operation in practice, however, showed that the remedy was a practicable one. With the new rotors designed for the application of heavy cage windings all trouble disappeared. The fourth machine installed, which has a 4,260-kilovolt-ampere, single-phase rating, has a solid steel core, in the surface of which the copper-cage winding is embedded. As the service was increased and the whole electric service established, it became evident that there was a serious condition existing in the system which was indicated by extremely violent shocks to everything in case of a short-circuit. It had been calculated that the machines would give possibly six or seven times full-load current on the first rush in the case of a dead short-circuit, this dying down to possibly two or three times normal full-load current. Oscillograph tests indicated, however, that under certain conditions each machine could give at the moment of short-circuit almost 5,000 amperes on one phase, the normal full-load current being 340. With three machines in parallel this would therefore mean that approximately 15,000 amperes could be delivered momentarily. The oscillograph tests also showed that this short-circuit current would be maintained at almost its maximum value for a very considerable period, due to the cage winding on the rotors of the generators. Apparently this current at the first rush is not appreciably greater than on the machine before the dampers were added, but without the dampers the field was more quickly killed, so that apparently the breakers did not open until the current had fallen somewhat. With the heavy cage winding on the field structure, however, secondary currents were set up in this winding, tending to maintain the field strength, and thus the current rush was maintained at almost full value for possibly twenty to thirty alternations.

The experience with the windings of the generators indicated that they were being subjected to enormous forces in the end windings. As the machines could give about fifteen times full-load current momentarily on short-circuit, the force acting on these end windings would be 225 times normal, and in this case these forces were so great that it became a serious problem to devise a type of bracing on the end windings sufficiently rigid to withstand such a force. In the endeavor to support these windings against movement, probably the most complete system of bracing ever applied to alternating-current generators was developed and used on these machines; yet in spite of this there was evidence of movement at times.

It was decided to limit this short-circuit current to the value originally intended, namely, about six times full load. This was done by an unsaturated choke coil or impedance coil on the trolley side of each machine, which coil takes up a comparatively small voltage under normal operation, but in case of a short-circuit the electromotive force generated in it is sufficient to limit the current rush to less than half the value it would attain without this coil. With the installation of the choke coils the shocks on the machine were greatly reduced, so much so that further trouble from this source is not feared. An interesting point in connection with the use of the cage windings is that the apparent regulation of the system has been improved.

L. B. Stillwell said that the engineering world was fortunate in the fact that the New York Central Railroad and the New Haven Company had not adopted the same electric system. Such an opportunity to compare the possibilities and limitations of the direct-current system and the single-phase, alternating-current system is unprecedented, and, except in America, would be impossible. Unquestionably, each and every problem of elec-

trification should be studied primarily with reference to local conditions, and such conditions might lead properly to the adoption of a system other than that which would be chosen to solve the more general problem of electrifying not only a terminal and limited suburban zone, but a railroad division or trunk line. The clear conviction and admirable courage of Frank J. Sprague in installing the multiple-unit system of train operation on the South Side road in Chicago was a most important advance in the art of railroading. The applicability of this system to trains requiring tractive efforts exceeding 50,000 pounds was demonstrated first in the New York Subway. The equipment of the New York Central had contributed to the demonstrated utilities of third-rail construction. The New Haven installation, substituting, as it does, 11,000 volts for 600 volts, and eliminating substations, opens the door to possibilities of electrification of railways over zones far beyond the reach of 600 volts, direct current.

A. H. Armstrong said that Mr. Murray was certainly entitled to the greatest praise for the frank presentation of the development period of the New Haven electrical installation. It was instructive to know how nearly the early claims which were advanced for the alternating-current systems have been fulfilled in the completed installation. The overcoming of difficulty after difficulty met with in operation is proof of the progress made in perfecting the complete electrical and mechanical equipment. In other words, the entire system, from the motors to the transmission, had been entirely changed from the original specifications, and this was what had been pointed out when the system was first announced. It was his experience that it costs fully twenty-five per cent more to construct an alternating-current, single-phase locomotive than one of equal weight equipped with direct-current motors.

He finds it hard to justify Mr. Murray's present enthusiasm for the system, which appears to him to be in many ways unsuited to the New Haven conditions.

Mr. Armstrong presented some figures which, he stated, showed that with approximately the same total weight a single New York Central locomotive unit has a capacity equal to two New Haven units, although the motors of the latter are cooled by forced ventilation, while in the New York Central motors natural ventilation is employed. Comparing the hauling capacity of the New Haven locomotive in handling a trailing load of 200 tons, he showed that the single New York Central locomotive was handling trains running from slightly over 400 tons to almost 700 tons. He said that each of these trains would have required at least two of the New Haven locomotives.

Mr. Armstrong said that he believed absolutely in the future of the alternating-current locomotive, but that it was his conviction that it was not adapted to the road upon which it was now being used.

N. W. Storer said that the publication of this paper should do much to silence the criticism which has been heaped upon the New York, New Haven & Hartford Railroad, and he paid a tribute to E. H. McHenry, who had borne the brunt of the storm without faltering in his determination to make the system a success. He took exception to some published reports which, he said, were written evidently without true knowledge of the capabilities of the single-phase motor. These motors have armatures, compensating winding and field all in series. They therefore have torque characteristics similar to those of a direct-current motor, in that, with a given current, the torque is the same for all speeds; that if the New Haven locomotive motors are taking 1,200 amperes each, that the tractive effort is 10,000 pounds, no matter whether the train is standing still or running at a speed of fifty-five miles per hour. The power-factor of the single-phase motor limits it only as it limits the maximum current that can be taken by it. Curves which he had plotted showed that the tractive effort at the one-hour rating for the New York Central motor is slightly more than double that of the New Haven. However, owing to the forced ventilation on the New Haven locomotive, its continuous capacity both in speed and tractive effort is higher than on the New York Central. This indicates that the New Haven locomotives will handle about the same weight of trains in express service as the New York Central, where the service is sufficiently continuous for the latter to get warmed up, even if the rate of acceleration is not so high.

H. P. Davis said that the problems encountered on the New Haven road are not simple nor within the scope of ordinary or established practice. Many conditions have arisen which it was impossible to foresee and guard against. Constructional difficulties, so long as they are not fundamental, do not affect the delay chain, except to the degree of time sufficient to investigate the troubles and to provide means to correct and eliminate them.

The paper was also discussed by E. B. Katte, Philip Torchio, Prof. C. L. de Muralt, William McClellan and Doctor Steinmetz.

Doctor Steinmetz said that his conclusion, from the evidence and data now available, was that those railway problems which cannot be handled by direct current must be solved by the alternating-current motor, and, as we know now, can be solved by the alternating-current, single-phase motor. But where direct current as well as alternating current can be used, the higher weight efficiency—that is, the greater draw-bar pull per pound of motor weight—afforded by the direct-current motor necessarily makes this motor preferable from the electrical engineer's point of view. It is interesting, then, to note that in those railway problems which can be handled by alternating-current motors as well as by direct-current motors, the decision whether one or the other type of motor shall be used has shifted from the electrical engineer to the railway engineer or the railway manager, and is determined by the economical question whether higher weight efficiency—that is, higher draw-bar pull per pound of motor weight—and at least at present a somewhat lower reliability of service are sufficient compensation and should be sacrificed for the possibility at some time of being able to extend the same system of operation over those parts of the road which cannot be operated by direct current, and over such other roads where direct current cannot be used; or whether the higher weight efficiency of the direct-current motor and present greater reliability of service compensate for the possibility that at some future time we may have to replace the locomotive equipment or change locomotives at the end of the direct-current zone and the beginning of the alternating-current zone.

After some desultory discussion the meeting was adjourned.

Northwestern Electrical Association.

The annual meeting of the Northwestern Electrical Association will be held at the Hotel Pfister, Milwaukee, Wis., January 20 and 21, 1909. An address will be made by Prof. B. H. Meyer, chairman of the Railroad Commission of Wisconsin, and discussion will be had on the rulings of the Commission, on tungsten lamps and other timely subjects.

QUESTIONS AND ANSWERS.

USE OF BELLS ON 220-VOLT CIRCUIT.—I have a number of bells that I wish to connect to a 220-volt direct-current circuit. They are now connected to dry cells, that I want to discard. What kind of apparatus must I have? I want something simple that I can make myself. Can ordinary dry batteries be recharged on direct current?—J. A. B., Chicago.

Substitute the 220-volt circuit with a 220-volt incandescent lamp in series for the dry batteries as the source of current. The lamp reduces the voltage at the bell to approximately what it is designed for. To prevent arcing at the bell contacts, a high-resistance shunt should be connected across them; a small coil of German silver wire, wound non-inductively, will suffice. Dry batteries cannot be recharged with any practical success. as the chemical action occurring therein is reversible with only a very low efficiency. When such a cell is exhausted it is much cheaper to throw it away and buy a new one than to expend any effort to recharge it.

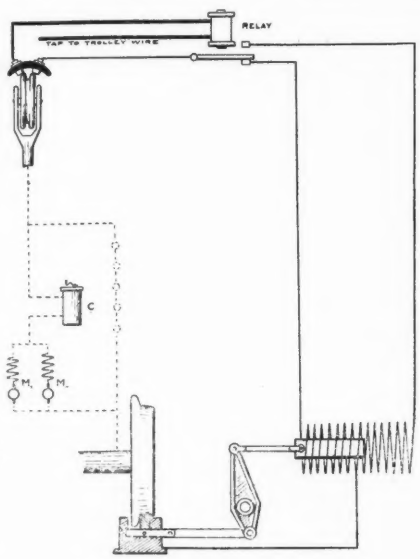
RATING OF OPEN AND ENCLOSED MOTORS.—A number of shunt motors that I have noticed are rated at so many horsepower and so many amperes "closed" and so many horsepower and amperes "open." What is the meaning of these terms as regards such motors?—M. A. L., Peoria, Ill.

When a motor is operated with the ordinary open frame there is much better ventilation of its windings than when the motor is more or less housed in or enclosed. In the latter case a smaller current will produce the same temperature rise of the conductors than a considerably larger current produces in an open motor. For this reason some manufacturers have a lower nominal rating for their "enclosed" motors than they have for the same motors in an "open" framework.

AUTOMATIC TRACK SWITCH.—Kindly explain the operation of the automatic street-car switches used on the South Side, as, for instance, the one at 18th Street and Wabash Avenue.—H. D., Chicago.

About sixty feet back of the track switch there is installed on the trolley wire an inverted trough with separate side contacts adapted to be engaged by the rims of the trolley wheel. The trolley wire is carried over this trough and is connected with one of the contacts through the coil of a relay mounted vertically on the trolley pole at the curb line. The contacts on the opposite side of the trough connect to the armature of the relay through a high resistance and fuse (not shown in the accompanying diagram). To the contacts engaged by the relay armature are connected the terminals of the two half windings of a solenoid, the core of which acts on the tongue of the track switch through a lever, the whole being mounted in a sealed box embedded between the rails.

When the motorman, in approaching the switch, allows the car to coast with his controller "off," the trolley wheel connects the opposite contacts in the trough, establishing a circuit through the relay, the high resistance, the armature of the relay, the lower contact and half the solenoid winding to ground. This current is not strong enough to actuate the relay, and therefore its armature remains on the lower contact, sending the current through the left half of the solenoid, and moving the switch to one side. When the motorman approaches the switch with the controller "on" the first or second



AUTOMATIC TRACK SWITCH.

point, the current through the relay is much stronger than before, since it finds a path of low resistance through the motors; the armature is therefore drawn up, and this sends current through the right half of the solenoid and throws over the switch. A strong spring in the track box aids in throwing the switch and holds it in locked position. This type of automatic switch is called the Chatham electric track switch.

SMALL GASOLENE-DRIVEN LIGHTING PLANT.—(1) In reading the article on "Lighting Country Homes by Private Electric Plants," that appeared in the WESTERN ELECTRICIAN of October 24, it was not clear to me whether the lights can be run directly from the dynamo while charging the battery. (2) If a person had a 110-volt dynamo, could he not use that by cutting in proper resistance while charging the battery? (3) Is it good policy to put the dynamo on a concrete foundation without putting a layer of wood between the machine and the foundation? (4) With the size of engine mentioned in the article (two horsepower) would it be necessary to have heavy fly-wheels on the engine to give steady speed or would a small marine engine do?—B. E. M., Seattle, Wash.

(1) The diagram of connections, shown in Fig. 5 of the article referred to, does not provide for running the lights from the dynamo when charging the battery except by closing switch s_3 while s_1 is down. During the battery charge the dynamo voltage is thirty to forty volts; this is pretty strong to put on twenty-five-volt lamps. The plant has been designed to be of as simple design as possible, therefore auxiliary apparatus to permit the object desired has not been contemplated. However, a rheostat of low resistance and large current capacity could be inserted in the lighting circuit above s_2 to cut the voltage down to twenty-five volts; it would have to be adjusted from time to time as the generator voltage was raised and the number of lights changed. (2) The use of a rheostat with a 110-volt dynamo to supply twenty-five-volt lights or a thirty to forty-volt battery is not advisable, as there would be too great an energy loss in the rheostat; in fact, two or three times as much energy being converted to heat as would be usefully employed. The rheostat, too, would have to be quite large and expensive in first cost. (3) A dynamo can be put down directly on the foundation if it is well bolted down to make it free from the engine vibrations. If the dynamo and engine are on the same foundation, a layer of wood would tend to deaden the vibrations. (4) Fairly heavy fly-wheels should be provided to give uniform speed. For this service specially-designed engines are now on the market.

CONSTRUCTION OF CONDENSERS.—Certain condensers used in wireless telegraphy have, I have noticed, a dead or disconnected conducting plate inserted midway between the active conducting plates. What effect does this arrangement have on the capacity of the condenser?—F. D. M., Uvalde, Texas.

The capacity of a condenser varies inversely as the square of the distance separating the plates. Thus if the dielectric and area of the plates remain the same and we are to halve the distance between them, the capacity of the condenser will be fourfold its original value. Again, two similar condensers connected in series

have a combined capacity half that of either. It is evident that in the case of two "active" plates between which is a free or disconnected conducting plate, we have two condensers in series, either one of which would have four times the capacity of that between the two outside "active" plates, since its plates are at only half the distance. Thus the net increase in the capacity of the condenser has been to double its effective capacity, without decreasing the actual dielectric distance between the connected plates, which determines the breakdown point of the condenser.

BOOK REVIEW.

"Heating and Ventilation," by Charles L. Hubbard. Chicago. The American School of Correspondence. 7x10 inches. 221 pages. Cloth. Supplied by the Electrical Review and Western Electrician for $1.50.

This volume was designed and written for purposes of self-instruction and home study. For this reason the language, and the explanations of the various apparatus and processes followed in heating systems are simpler than is usually the case in text-books. The book is divided into three parts, entitled, respectively, "Systems of Warming;" "Indirect Steam Heating," and "Vacuum Systems."

The first part describes the various systems in use, including the common hot-air furnace and direct steam-heating systems. This part is rather elementary in character and presents numerous illustrations of forms of apparatus, methods of piping and details of construction. The calculations necessary for the proper design of a heating system, both as to heating surfaces and the radiating surfaces of rooms or buildings, are explained in a clear and simple manner.

Part II, dealing with indirect steam heating, hot-water heating and exhaust-steam heating, covers much the same ground in relation to these systems as does Part I, in regard to the systems there discussed. The same may be said of Part III, dealing with vacuum heating. Temperature regulation is described in this section, and a short note is appended on the care and management of apparatus. The book contains much information of value to the student, although he is required to take much for granted. Information is not given as to the derivation of the rules or laws laid down in the work, and the student will have to go to other sources to find them. However, these rules and laws, together with the tables accompanying them, are conservative in their values and well on the side of good

Thirteenth Annual Meeting and Banquet, December 11.

The thirteenth annual meeting and dinner of the Electrical Trades Association of Chicago was held in the banquet hall of the Chicago Athletic Association on Thursday evening, December 11. An excellent menu was discussed, Thomas I. Stacey, treasurer of the Electric Appliance Company, acting as toastmaster. Addresses were made by B. E. Sunny, president of the Chicago Telephone Company; Albert H. Elliott, secretary of the Pacific Coast Electrical Trades Association; James J. Barbour, of the Chicago Bar; A. O. Kuehmstedt and F. M. Pierce. William A. Browne, president of the association, introduced the toastmaster. During the progress of the banquet a number of old songs were sung, led by the master chorister, Harry R. Parsons.

A very pleasant feature of the dinner was the rendition by A. O. Kuehmstedt, in a fine tenor voice, of an original song to the tune of "Illinois," interpolating a sketch on "Mr. Vose." Toastmaster Stacey read a poem which he had composed himself as a tribute to James Wolff, National Representative of the association, but who was unfortunately absent. Those present insisted upon hearing Mr. Stacey's effort, which was received with the greatest enthusiasm:

Whose "glad hand" is always out
With welcome warm, and hearty shout?
Sunny Jim, Sunny Jim.

Who has the car that always motes
As many friends around he totes?
Sunny Jim, Sunny Jim.

Who has the tickets to the show
Where willing buyers gladly go?
Sunny Jim, Sunny Jim.

Who is it shows the boys the town
When strictly business brings them down?
Sunny Jim, Sunny Jim.

Who is it travels "down the line,"
But comes back smiling fresh and fine?
Sunny Jim, Sunny Jim.

Who has the lines that always sell,
And their good points, who knows so well?
Sunny Jim, Sunny Jim.

Who is it takes the orders in
When others say that trade is thin?
Sunny Jim, Sunny Jim.

Who is it smiles and winks his glim
When rivals try the axe on him?
Sunny Jim, Sunny Jim.

Who is it brings about a truce
When all the rest would raise the deuce?
Sunny Jim, Sunny Jim.

Who is it smooths the troubled way
When others say there's "hell to pay?"
Sunny Jim, Sunny Jim.

My song is sung—My muse is dim,
Step lively, boys, the treat's on him.
Sunny Jim, Sunny Jim.

The report of Secretary-Treasurer Frederic P. Vose showed that the present membership is 201, as compared with 188 a year ago. There were handled during the year 4,315 listings, as compared with 3,106 last year, making a total of 19,680 since the organization of the association in 1896. Last year there were 3,318 settlements effected. The Executive Committee had declined to act on only thirty-four complaints because of disputed accounts.

The election of officers resulted as follows: President, William A. Browne, M. B. Austin Company; vice-president, F. M. Pierce, Manhattan Electrical Supply Company; Executive Committee (to serve until 1911), H. R. Parsons and F. M. Horton; national representative, James Wolff.

Wilmington Electric Company Awards Prize of House-Wiring.

The Wilmington (Del.) City Electric Company recently held an exhibition at its salesrooms and offices, 603 Market Street, and during the exhibition each of the callers at the salesrooms was requested to register. At the conclusion of the registration the names were all placed on small cards, put into a box and well shaken. J. Berndt, who is in charge of the specialty department, for the company, stepped to the door and called in a small boy from the street, and the lad drew three of the checks, the third to be the one bearing the reward, which was tendered to G. Brown, 510 East Ninth Street.

As a result, Mr. Brown will have the privilege of having his house wired to the extent of $25 worth of material and work. Had his home been already wired he would have had the privilege of selecting the best table, or standing lamp in stock in the store. The award was conducted in the front window of the establishment, and the spectators witnessed the action with interest.

Electrotherapeutic and Radiology Convention.

A convention devoted to the medical and scientific professions will be held from July 6 to July 9, next year, at the University of London, England, to discuss the most recent developments in electrotherapeutics and radiology. Exhibits of apparatus and appliances will be made, and the object of the conference and exhibition will be to attract the attention of the medical profession generally to the developments of these branches of science. The organizing secretary is Ernest Schofield, 11 Chandos Street, Cavendish Square, London, W. C., England.

HISTORY OF AXLE LIGHTING.[1]

BY W. L. BLISS.

Axle lighting is as old as any form of electric lighting ever suggested for or experimented with upon railroad cars. It is older than the head-end steam system, and dates back to within less than half a dozen years of the commercial births of the incandescent lamp and the storage battery, while the first practical and commercial dynamo is not more than a dozen years older than the first proposition to light a railroad car with an axle-light system. It is the intention of the writer, not so much to compile a thoroughly accurate chronological record of this art, nor to discuss in detail the various schemes that have been brought forth from time to time, but to deal more particularly with the development of methods and principles, leaving the minor details to be discovered and discussed by those who are interested in the subject.

The patent history of axle lighting is quite voluminous, several hundred patents having been issued to various American inventors alone for their improvements in axle-lighting apparatus, while numerous foreigners have protected their inventions in the United States. The earliest English patent that the writer has been able to obtain upon this subject is No. 5316 of 1881, issued to Richard Laybourne, in which the broad principle of a generator driven from a car axle and used in connection with incandescent lamps and a storage battery, was applied to the lighting of a railroad car. As he names the four essential elements of any axle-lighting system, this patent certainly must be regarded as fundamental.

As far as the writer has been able to discover through the records of the Patent Office, the oldest man in the axle-light business who is still actively engaged in this work, is Morris Moskowitz. The next oldest, in point of years devoted to this art, is Patrick Kennedy, while the writer believes that he himself is entitled to third place.

The writer believes that the first incorporated company to exploit axle lighting in the United States was the National Electric Car Lighting Company, of which Morris Moskowitz was the electrical engineer. This company is no longer in existence, but has been absorbed by the Consolidated Railway Electric Lighting and Equipment Company, which is still very much in existence and which has absorbed and taken over a number of companies identified with axle lighting. Mr. Kennedy began his active career with the American Railway Electric Light Company, which likewise has been absorbed by the Consolidated Railway Electric Lighting and Equipment Company. The writer began his stormy career, not with any company, but between two companies, the American Railway Electric Light Company and the Lewis Electric Company. Both had their births in the factory of the Riker Electric Motor Company, of Brooklyn, N. Y., where the writer was employed in the humble capacity of chief enginer, head draftsman, office boy, guest entertainer and general utility man. These were the early days of axle lighting. Many were the schemes propounded and many were the disappointments encountered. But with these small beginnings, the writer believes that today we are on the verge of a great era of axle lighting, and that many of those who were pioneers in this early work and assisted in its development will yet witness the triumph of this wonderful art. It has been fascinating to all those who have engaged in it, and while enormous sums of money have been spent in its development without corresponding returns, the writer believes that the day is not far distant when those who have created and developed this industry will reap the benefit of their exertions.

As mentioned in the patent history above, the essential elements of an axle-lighting system are a revolving axle, a generator driven thereby, a set of storage batteries and some incandescent lamps. This sounds very simple and easy of application, but twenty-eight years have elapsed since this proposition was first propounded. In all that time, axle-light apparatus has not become as standard as automobiles, although it is probably more standardized than flying machines. It was early seen and appreciated that more apparatus would be needed than the four elementary pieces already mentioned.

Beginning with the axle, there has probably been quite as much ingenuity and both useful and useless effort expended upon methods of driving the generator as there have been upon any other parts of the system. The earliest practical method of driving the generator was by means of a belt, the generator being mounted directly upon the body of the car. This method was applicable and feasible in England, where cars with rigid trucks were almost exclusively the rule, and even today this method continues to be the favorite in England on rigid truck cars and has even been extended to swinging or bogie-truck cars in England, the United States and a great many other countries. The body-mounted belted generator was certainly the pioneer, and it has not been entirely supplanted at this date. All sorts of methods have been devised for maintaining the tension of the belt. Idlers of all kinds, double, single and multiple, have been suggested and experimented with. All kinds of supports and mountings for the generators have been developed. They have been pivoted on the top, pivoted on the bottom, placed on rollers and supported on slides, while means for producing resilient tension have consisted of spring, gravity, compressed air, magnetic, vacuum, hydraulic, centrifugal and various other kinds of devices. We also find that it has been the intention of some inventors to allow their belts to slip, others to keep them from slipping, while most inventors have generally succeeded in developing a method of maintaining the tension on their belts that has acted exactly the opposite from what they intended. In most cases where it was intended that the belt should slip, it has generally stuck fast and driven with great vigor. In cases where it was intended that the belt should stick, it has slipped most provokingly.

It will be impossible to relate the various troubles that have developed in simply the means for maintaining belt tension. To obviate the difficulties in maintaining proper belt tension, schemes have been developed whereby the tension could be adjusted by an attendant in the car. Automatic devices for varying the tension of the belt to compensate for wear in bearings, stretch in the belt, etc., have been designed which have contained as much machinery in the shape of motors, worms, gears, limit switches and the like, as would be found in a complete and modern axle-light equipment.

When we consider, however, the question of driving the axle generator in connection with the problem of taking care of its polarity, the task of the historian becomes Herculean. To describe the double-belt systems, using open and crossed belts, the shifters for changing from one belt to the other, the ratchet schemes for allowing one belt to drive in one direction and the other in the other direction; to describe the countless methods of maintaining constant speed by

[1]Abstract of a paper read before the Association of Car Lighting Engineers at the convention in Chicago on November 16.

means of belt combinations with cone pulleys of the Evans type, flyball governors, revolving oil tanks, sliding collars, drums, worms, back gears and sundry similar schemes, would occupy too much time and be altogether uninteresting.

There have been one or two fairly good propositions brought forward for maintaining motion of the generator after the train comes to a stop. The best of these schemes, it seems to the writer, was that employing an air compressor driven from the axle, which stored air in a tank and in turn operated an air-driven engine connected to the generator. The efficiency of such a system could not be high, but it at least has the virtue of being a means of storing energy without employing a storage battery. While schemes of this kind evoke perhaps a smile, they are really no farther from being adopted by practical railroad men than many of the other apparently more feasible schemes that have been advanced from time to time.

The early methods of gear drive were all designed to overcome the difficulty that arose from the fact that the distance between the center of the axle and the center of the generator continually varies unless the generator frame be journaled upon the car axle in the manner adopted in all modern street-railway motors. The only parts of a railroad truck that maintain any kind of a fixed relation with the axle are the journal boxes and equalizer bars, and even these do not maintain a strictly constant relation. The equalizer bars were early employed to secure the bearings for a gear which might in turn engage with a gear upon the axle, and from the gear mounted upon the equalizers, a connection was carried to the generator, either inside of the car or upon the track. The writer's earliest experience with an axle generator was with one of this type wherein the generator was located inside of the car above the truck and a telescopic shaft with two universal joints transmitted the motion from the gear mounted upon the equalizer bars to the generator inside of the car. Complicated as this construction may seem, it is exactly, in all respects, the standard form of transmission found in the best automobiles today, and there isn't any real reason why a system of transmission such as is employed on automobiles should not be used for operating an axle generator. Developments have not taken that trend, and it is doubtful whether anything further will be developed in this line.

Several other types of direct gearing have been developed and experimented upon. Probably the best known of these methods were the false-sleeve system of Biddle and Kennedy, and the hollow-shaft system of the writer. Both of these systems aimed to accomplish the same purpose. In the former device the false sleeve was mounted upon the axle, and upon this sleeve the proper journals were turned and the proper gear seat finished for making a veritable street-railway mounting, the idea being to take the rough axle as it was found and leave it in the same condition, no tooling or machining of the rough axle being permissible. It is the writer's belief that, if the railroads had met the problem of axle lighting in a more liberal manner and had had special axles prepared, as in street-railway practice, axle lighting would have been developed, so far as the generator is concerned, a great deal earlier, although it must be said that generators mounted inside of the truck have the great disadvantage of inaccessibility, and steam railroads are not prone to furnish inspection pits for facilitating the care and inspection of axle-light apparatus.

The direct-gear system, devised by the writer, differed from that of Biddle and Kennedy in that none of the weight of the machine was carried upon the axle. The hollow shaft surrounded the axle, but did not touch it. Motion was communicated by a flexible though positive connection from the axle to the hollow shaft, and upon the hollow shaft was mounted a gear which drove the generator pinion. The bearings for the hollow shaft had to be considerably larger than in the case of the Biddle and Kennedy arrangement, but the machine had the advantage that it rode upon the truck frame and was free from the direct shock communicated by the axle in the Biddle and Kennedy device. Both these arrangements were developed on a commercial scale and went into actual service; it is the writer's belief that a few of them can be found in commission today.

[To be concluded.]

New York State Public Service Commission Notes.

The report of the gas-meter tests by the New York Public Service Commission for November shows that during that time 30,126 meters were tested, of which nine per cent of the meters complained of were correct, fifty-seven per cent fast and thirty-four per cent slow. Of the total fast meters, thirty-six per cent were two per cent or more fast; and of the slow meters, ten per cent were more than two per cent slow, leaving fifty-four per cent within two per cent of normal.

The report shows that forty-seven electric meters were tested, of which 76.5 per cent were within four per cent of normal, 8.5 per cent were four per cent or more slow, and fifteen per cent were four per cent or more fast.

The Public Service Commission has decided to requisition the Board of Estimate and Apportionment for $987,500 to defray the expenses of the Commission for the calendar year 1909. This compares with $1,095,000 for the present year.

The Public Service Commission, Second District, has issued an order to all railroad companies, requiring them to file with the Commission, on January 1, a statement as to the methods employed by corporations respecting the transmission, filing, arrangement, and the checking at stations of schedules showing rates, fares and regulations applying to the transportation of passengers and property.

Comparison of the Working Costs of Small Arc Lamps and High-Candle-Power Osram Lamps.

A recent number of the *Elektrotechnische Zeitschrift* contains an article by H. Remané, dealing with this subject. It appears that the Auer Company is turning out osram lamps of 200, 300 and 400 candlepower, suitable for burning on circuits whose voltage lies between 110 and 130 and between 200 and 270 volts. These lamps have a life of about 800 hours, the candlepower diminishing five or six per cent in that time. The ratio of the mean hemispherical illumination to the mean horizontal illumination is about 0.82, and the efficiency is about 1.33 watts per candlepower. These lamps, when used for interior lighting, are fitted with a reflector, and when employed outside, with both a reflector and clear-glass globe, the figures for efficiency then become 0.98 and 1.05 watts per candlepower, respectively. The results obtained of the cost of energy with different types of lamp and by different observers, taking the cost of current to be four-and-one-half pence per unit, are given in the tables below:

Table I.—Consumption in Watts per Candlepower for Direct-Current Enclosed Arc Lamps.

Amperes.	Remané.	A. E. G.	S. S. W.*
3	2.1	1.01	1.05
4	1.7	0.95	0.9
5	1.5	0.84	0.86
6	1.4	....	0.93

Table II.—Upkeep Cost in Pence per Hour per 1,000 Candlepower.

	Osram Lamps.	Arc Lamps.	
Amperes.	Remané.	Remané.	A. E. G.
1	....	....	....
2	4.65	....	....
3	4.65	9.6	4.7
4	4.65	7.7	4.4
5	....	7.7	3.8
6	....	6.2	....

*Siemens-Schuckert Werke.

Electricity Versus Steam for Trunk-Line Operation.

In the New York *Times* of November 29, William J. Wilgus, under whose direction the electrification of the terminal zone of the New York Central & Hudson River Railroad Company was inaugurated and carried well to completion, has written interestingly on the probability of the general electrification of main lines. Mr. Wilgus says:

"While many of those who are engaged in the practical application of electricity to the art of transportation naturally hesitate to prophesy on what the future may bring forth, they may at least venture the expression of a desire for that which they would like to see accomplished in the field of invention.

"The successful substitution of electricity for steam in terminals in large cities has stimulated the curiosity of the public as to the rapidity with which the change will spread, until that well-tried friend of eighty years' standing, the steam locomotive, will be relegated to the museum. Statements have been made that ten years will see this revolution accomplished, but it is perhaps needless to say that they are groundless.

"The early electrificaton of steam railroads in great centers of population is inevitable, because the demand of the public for the removal of the disagreeable features incident to the use of the steam locomotive is reinforced by the benefits that will accrue to the railroads in increased earning capacity and the possibilities of economies that will at least tend to offset the interest charges on the cost of the change. Away from the large cities the prospects for the eclipse of the steam locomotive are very remote, pending the perfection by the inventor of devices that will substantially reduce the cost of installation and thereby minimize the burden of additional fixed charges. For instance, with the direct-current third-rail system the cost of distribution of electric power is large owing to the need of expensive substations for the conversion of high-pressure alternating current, so well suited for economical transmission to the low voltage direct current for working purposes in the third rail and motors. Attempts to escape this expense by the use of the overhead alternating-current system have not been entirely successful where adopted on trunk lines, as the saving in substations has been offset by the greater weight and cost of electric locomotives, and by unreliability of operation.

"This question of comparative cost and reliability is the real point at issue in the warfare that has been hotly waged for the past five years over the relative merits of these two systems. Until this dispute is definitely settled no great progress can be expected in the general application of electricity on steam railways.

"Apart from the substantial reduction in the costs of installation of electricity on steam railroads that will follow a satisfactory solution of the problems of the rival system there are a number of other opportunities for advance in the art. For instance, the development of waterpowers and the utilization of cheap fuel at the mines, combined with an extended permissible radius of transmission, will all tend to lower the costs of current to prospective users at remote points. Then, too, improvements are constantly being made in power station design by minimizing the losses accompanying the conversion of fuel into energy. The simplifying of signal systems so as to reduce the cost on electrified steam railways is also an important item. The necessary safeguards for protecting the movement of heavy trains at short intervals on electrified trunk lines are now very expensive and one of the principal handicaps to the widening use of electricity.

"The high first cost and the expense of maintenance of batteries now preclude their more extensive use for insuring reliability of train service and lessened cost of operation. Their improvement will not only overcome that obstacle, but will also make more practicable the use of electric locomotives that will be non-dependent on third rails and overhead conductors, particularly in yards and terminals.

"It is hoped that in the early future the question of the preferential electric system for adoption on steam railways will be conclusively settled, and that improvements in the generation, transmission and conversion of current, and in signals and rolling stock, with due regard for safety and reliability, will largely reduce the cost and increase the efficiency of electrical appliances. When that time comes the steam locomotive may well look to its laurels."

Mr. Wilgus is chairman of the Board of Advisory Engineers of the Detroit River tunnel of the Michigan Central Railroad, and is prominently identified with a number of other large industrial organizations. He is the head of the Amsterdam Corporation, which is seeking powers to build and operate an extensive system of electrically-operated freight tunnels, serving the water-front and warehouse districts in New York city.

Armour Institute Branch, American Institute of Electrical Engineers.

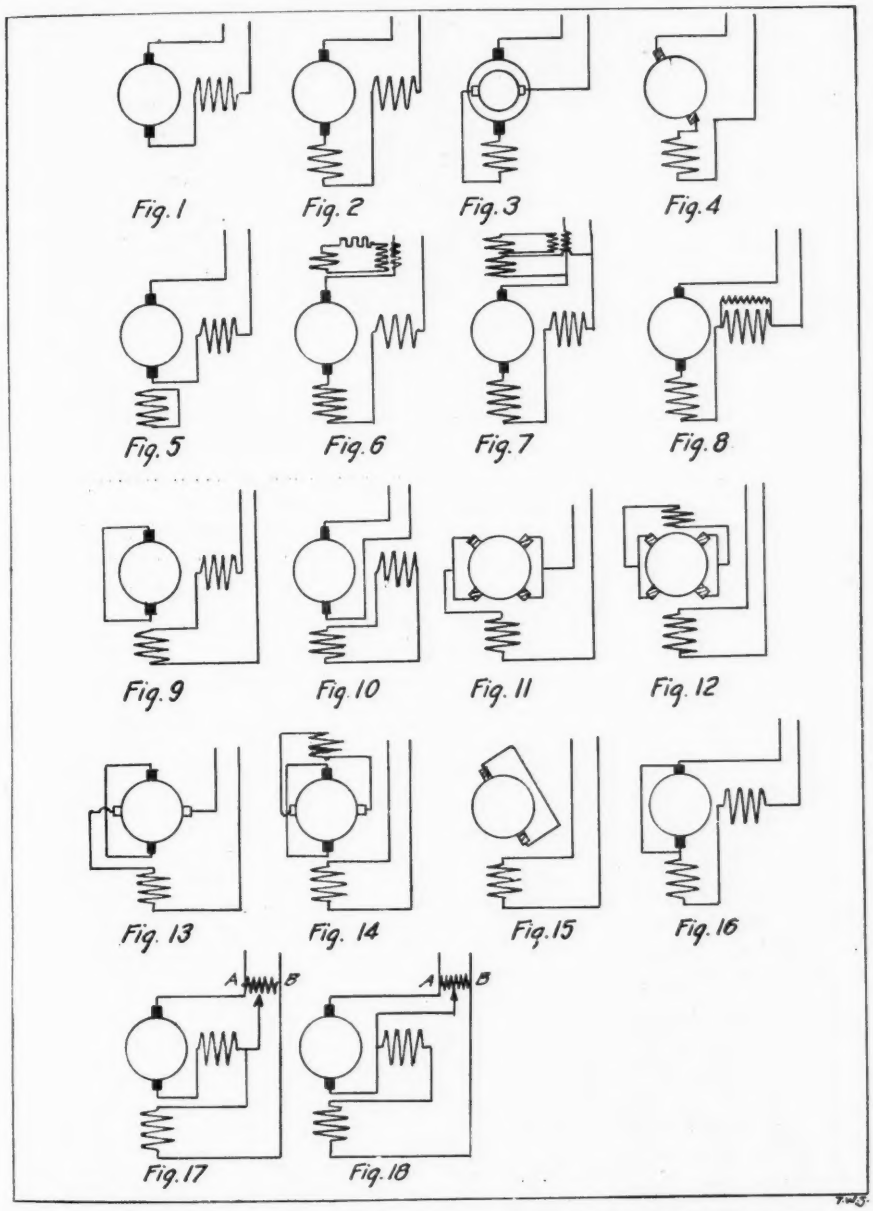
On December 3 the Armour Institute of Technology Branch of the American Institute of Electrical Engineers held a well-attended meeting, the topic of the evening being the presentation and discussion of a paper by Tracy W. Simpson on "The Alternating-Current, Single-Phase, Commutator Motor."

A large number of commutator motors of various forms, as developed both in this country and in Europe, were described in considerable detail and a brief explanation made of the principle of design of each type. Each type of motor was studied from the standpoints of commutation of load component of current, commutation of short-circuit component of current, rotor reaction, power-factor, torque per volt-ampere, and ability to operate on direct current.

The various methods of improving operation along these lines, as exemplified in the various types of motors, were considered in some detail. In addition to explaining many of the complex phenomena of operation, the new method of improving power-factor, consisting of an auxiliary winding on the exciting field connected as a shunt across the mains, was illustrated by means of vector diagrams. This method is due to Osnos, of the Felten and Guilleaume-Lahmeyer Werke. Attention was called to the superior operating characteristics of the series repulsion motor as well as to the general improvement attainable by motors having both stator and rotor power. It was stated that this motor compared unfavorably with the compensated series type employing resistance leads for long continued overloading at starting, such as would be occasioned by the wheels of a locomotive being locked from too heavy trailing load.

A very interesting set of diagrams, reproduced herewith, was shown of the circuits of most of the motors described. All the diagrams apply to two-pole motors with uniform gap reluctance. The energy axis is shown vertical, the exciting axis horizontal. In the brief synopsis of the various diagrams given below the following abbreviations are used: "Compensated"—in which the pulsating rotor reaction along the energy axis is completely damped; "neutralized"—in which the electromotive force due to the alternating field in the short-circuited coil undergoing commutation is balanced; "rotor power"—that introduced into the

rotor by conduction; "stator power"—that introduced into the rotor by induction from the transformer winding on the stator; "rotor field"—exciting field from the rotor, the flux from which is not compensated on the exciting axis; "stator field"—exciting field from the stator coils, fed either by conduction or induction; "series motor"—having the field in series with the energy current of the rotor; "repulsion motor"—having stator power and hence two fluxes of ninety degrees space and time phase and of comparable magnitudes.



CIRCUIT DIAGRAMS ILLUSTRATING MOTOR CHARACTERISTICS.

The first four diagrams relate to direct-current series motors, since an understanding of the action of these types is useful as an aid to analyzing their alternating-current counterparts and derived forms.

Fig. 1.—Stator field, compensated by changing reluctance from uniform value, i. e., projecting poles not neutralized.

Fig. 2.—Stator field, compensated, or neutralized and compensated, by counter field on energy axis.

Fig. 3.—Rotor field, compensated, or neutralized and compensated.

Fig. 4.—Rotor field, operates due to partial compensation along energy axis.

The following six diagrams illustrate common types of alternating-current series motors; the names given are those of the inventor or manufacturer:

Fig. 1.—Stator field, compensated by high reluctance along energy axis; Finzi.

Fig. 2.—Stator field, conductively compensated; Lamme (Westinghouse Electric and Manufacturing Company).

Fig. 5.—Stator field, inductively compensated; Eickemeyer.

Fig. 6.—Stator field, conductively compensated and neutralized; Oerlikon Maschinenfabrik.

Fig. 7.—Stator field, conductively compensated and neutralized; Siemens-Schuckert Werke.

Fig. 8.—Stator field, conductively compensated, resistance shunt to field; McAllister.

The following seven diagrams illustrate various types of alternating-current repulsion motors:

Fig. 9.—Stator field, stator power, conductively compensated; Atkinson.

Fig. 10.—Stator field, rotor power, inductively compensated, not a true repulsion motor.

Fig. 11.—Rotor field, stator power, conductively compensated; Latour (Felten and Guilleaume-Lahmeyer Werke).

Fig. 12.—Same as Fig. 11, for high voltage.

Fig. 13.—Rotor field, stator power, conductively compensated; Winter-Eichberg (Allgemeine Elektrizitäts Gesellschaft).

Fig. 14.—Same as Fig. 13, for high voltage.

Fig. 15.—Rotor field, stator power, conductively compensated on energy axis, original repulsion type; Thomson.

The last three diagrams show motors having both stator and rotor power.

Fig. 16.—Stator power by over-compensation, excess current thus occasioned is short-circuited; rotor power by series method (Fig. 2); Alexanderson type at starting; General Electric Company (1907).

Fig. 17.—Stator power by action similar to Fig. 9 if field of latter be in rotor circuit, this is only action with moving contact at A; rotor power by series method similar to Fig. 5, this is only action if moving contact is at B; Alexanderson type at running points; General Electric Company (1907).

Fig. 18.—Combination of Figs. 9 and 10, depending on position of contact, stator power only with contact at A; rotor power only with contact at B; both actions repulsion method; Felten and Guilleaume-Lahmeyer Werke.

There were also described several motors having constant speed characteristics, such as the Wagner, Schüler and Fynn types. These are not illustrated in the diagrams, however.

ALTERNATING CURRENTS AND THEIR APPLICATIONS.

BY EDSON R. WOLCOTT.

CHAPTER II. (PART II.)—ROTATING MAGNETIC FIELDS.

ADVANTAGES OF ROTATING-FIELD ALTERNATORS.

From the point of view of simplicity of construction and economy of operation,

FIG. 48.—ALTERNATOR WITH DIRECT-CONNECTED EXCITER.

there are advantages in rotating the magnetic poles rather than the armatures of alternators. Better mechanical construction, as well as more perfect insulation of the armature windings, is attained in this way, and no collecting rings for the generated current are necessary.

This type of alternating-current generator has almost entirely displaced the revolving-armature type, except in the case of some small alternators. The large machines, of which an example is shown

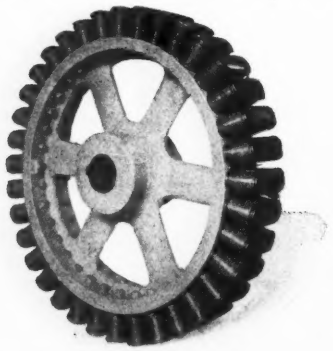


FIG. 49.—REVOLVING FIELD STRUCTURE.

in Fig. 47, are invariably of this type. The alternator illustrated is a 6,600-volt generator, to be connected directly to the prime mover. It has a capacity of 4,000 kilowatts.

DETAILS OF A ROTATING-FIELD ALTERNATOR.

In Fig. 48 is shown a 105-kilowatt revolving-field alternator, having a direct-connected exciter, and arranged for direct-connection to an engine. The revolving-field structure is shown in Fig. 49, while a more detailed view of the field coil and laminated pole-piece is disclosed in Fig. 50.

FIG. 50.—LAMINATED POLE-PIECE AND EDGE-WOUND FIELD COIL.

The alternator frame, illustrated in Fig. 51, shows the armature windings on the inner side. In the rear are the coils and frame of the magnetic field of the

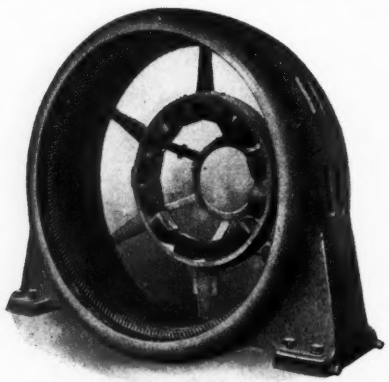


FIG. 51.—ALTERNATOR FRAME AND EXCITER FIELD.

exciter, the armature of which is illustrated in Fig. 52. This is mounted on the shaft close to the revolving field and generates a direct current to supply the field coils.

Fig. 53 shows the method of winding

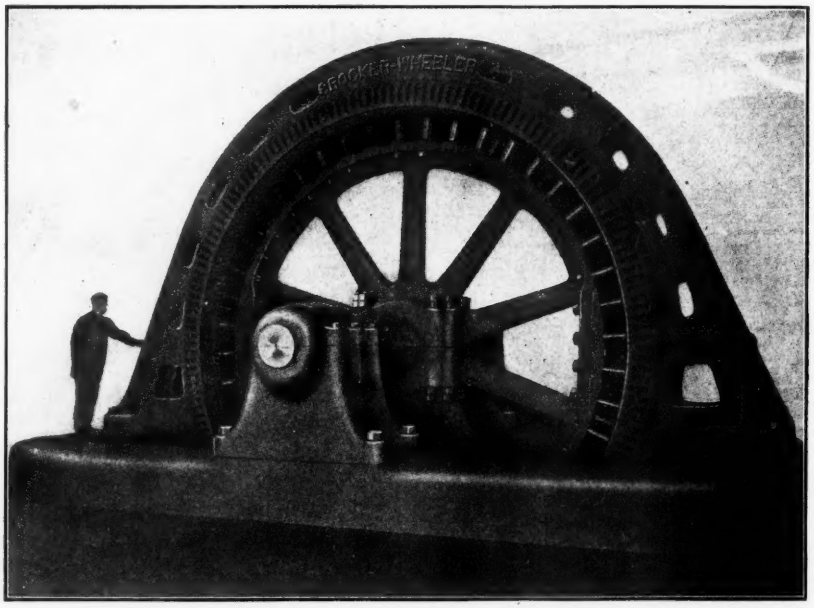


FIG. 47.—4,000-KILOWATT, 6,600-VOLT REVOLVING-FIELD ALTERNATOR.

the separate armature coils, which are shown assembled in place in Fig. 51.

A detailed view of the arrangement of

FIG. 52.—EXCITER ARMATURE.

the armature coils of a 500-kilowatt alternator of the revolving-field type is shown in Fig. 54.

EXCITATION.

Most generators of this type are separately excited. In some cases the exciter

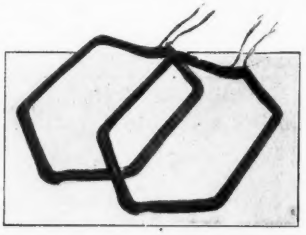


FIG. 53.—ARMATURE COILS.

armature is mounted on the same shaft with the field coils, as already shown in Fig. 48. With large generators, the exciters are usually belted either to the alternator or directly to the prime mover,

or may be driven by a separate engine or motor. The electromotive force of the exciter is usually about 125 volts.

COMPOSITE EXCITATION OF REVOLVING-FIELD ALTERNATOR.

In sizes below 100 kilowatts capacity it is customary to build machines with composite field windings, as illustrated in Fig. 55. G represents the alternator and D the direct-current exciter. Y is the shunt-wound field coil of the exciter and X the series coil. The shunt winding contains the rheostat, r, while another

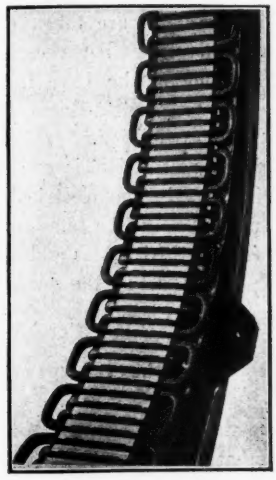


FIG. 54.—STATOR FRAME, SHOWING ARMATURE COILS IN POSITION.

rheostat, R, is connected in series with the exciter circuit. The circuit terminates in the collecting rings, L, which conduct the current to the revolving field coils. The two rheostats allow a wide range of variation of the exciting current. Additionally the commutator, C, feeds the field coils from the transformer, T, whose primary, P, is in series with the line, while the secondary, S, is connected to the commutator, C, which rectifies the current delivered to the field coils.

VENTILATION.

The hysteresis losses in the iron cores of the armature and fields appear as heat, as do also the I^2R losses in the conducting coils and the eddy current losses. It is, therefore, very essential that proper precautions be taken for cooling both the armature and the field. An excellent method of accomplishing this is illustrated in Fig. 56. The air passes up through the ventilating ducts of the field cases and then through those of the armature as shown by the arrows.

VOLTAGE CONTROL.

Voltage control of large alternators is usually attained by hand regulation, and an attendant is stationed at the switchboard for this purpose. For medium-sized machines, however, automatic regulation is being introduced to some extent as, for example, by the Tirrill regulator, which is essentially an automatic field rheostat.

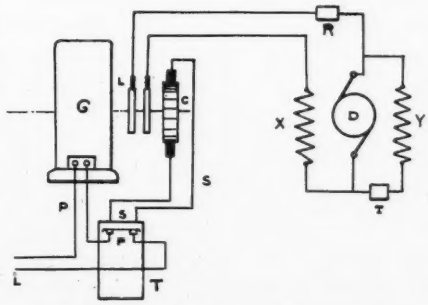


FIG. 55.—COMPOSITELY-EXCITED ALTERNATOR.

It operates by periodically short-circuiting a fixed resistance, instead of varying the amount of resistance in the circuit. The effect is practically the same as cutting out some of the resistance in circuit. With a normal resistance of ten ohms which is short-circuited for one-half the

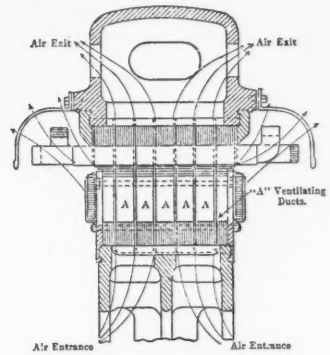


FIG. 56.—CROSS-SECTION THROUGH FIELD AND ARMATURE, SHOWING VENTILATING DUCTS.

time the result is evidently the same as if there was a resistance of only five ohms in the circuit.

New York Independent Telephone.

Justice McLean, in the New York Supreme Court, Friday, December 11, reserved decision on the application of the New York Independent Telephone Company, for a writ of mandamus to compel the Commissioner of Water, Gas and Electricity of New York city to permit it to run an electric wire through the pipe of the Empire City Subway Company, along the south side of Wall Street, from William to Hanover Streets. The corporation counsel opposed the application, and said that, while the application was only for a writ for that one space, it was, in reality, an attempt to get the use of all the city streets and subways.

Non-Magnetic Yacht for Ocean Surveys.

The Carnegie Institute, Washington, D. C., has awarded a contract to the Tebo Yacht and Basin Company, of Brooklyn, N. Y., for what will be in many respects a unique vessel. The Department of Terrestrial Magnetism of the Institute has authorized Wallace Downey, the builder of the yacht Meteor, for the German emperor, to construct a yacht to be used in making surveys. It is understood that, with one possible exception, there will not be a scrap of steel or iron in the craft, although it will, of course, be provided with an engine, machinery, and all other equipment of a modern vessel.

The yacht is to be called the Carnegie, and will be used in making ocean surveys. It is planned to eliminate errors which have crept into ocean surveys, due to magnetic variations, caused by the influence of steel on board ships. The vessel will be 155 feet long, thirty-three feet beam, twelve feet draft, and will be barkentine rigged and cost approximately $125,000. It will be primarily a sailing vessel, with an auxiliary gas engine. The propelling engines, machinery and other parts of metal on the craft will be of manganese bronze and gun metal. The contract calls for the delivery of the vessel to the Carnegie Institute by July 1, 1909, and it is announced that its first voyage will be to the North, visiting Hudson Bay and Greenland.

Electric Traction at Odessa.

The *Elektrotechniker* announces that the municipality of Odessa has decided to construct a system of tramways, and has granted a concession to a Belgian company which holds similar rights over the present horse lines. The system in question, says the London *Electrician*, will have a mileage of ninety-five, half of which will be single-track. The gauge will be one metre, and Phœnix rails, weighing ninety pounds per yard, will be used in the town and Vignoles rails, weighing seventy-six pounds per yard, in the suburbs. The trolley system will be adopted throughout. The generating station will contain four generator groups, each having a capacity of 1,000 kilowatts. Alternating current will be distributed at the generator pressure of 6,000 volts to six substations, where it will be transformed to continuous current at 550 volts. The rolling stock will be made up of 250 motor cars, as well as trailers. It is estimated that the total expenditure will exceed £1,250,000.

Co-operative Credit Protection.

An address on "Co-operative Credit Protection" was delivered before the Chicago Credit Men's Association by Frederic P. Vose, secretary of the Electrical Trades Association of Chicago, last month. Mr. Vose said in part:

Co-operation in business is an economic ideal; in social science it is applied to voluntary unions of persons; in matters of joint protection, purchase, distribution, consumption and the like on an equitable basis for their mutual benefit. It is the concert of many for the compassing of advantages impossible to be reached by one. It is fraternal.

We have all learned that commerce does not necessarily mean relentless competition and eternal strife; rather it is intercourse and exchange not only of wares and merchandise but of thoughts, ideas and practical information, and we have in this co-operative association work a combination or mutualization which makes for business morality, stability and prosperity. It is thoroughly opposed to petty trade jealousies, levels the selfish barriers between competitors and promotes the spirit of conciliation and unity of interest between those engaged in the same line, and from its inception has taught that co-operation and not competition makes for the more abundant and satisfactory life in and out of trade.

"Co-operative credit protection" has become the motto of organizations formed in the electrical trade as well as those among manufacturing and jobbing plumbers, heavy and light hardware dealers, jewelers, woolen manufacturers, paint manufacturers, stationers, brewers, butchers, bakers and candlestick makers, and a thoustand and one more.

Confining ourselves now to the consideration of how these organizations work, it is sufficient to say that in the main those engaged in a given line of trade become members of a corporation, organized not for pecuniary profit but in order to secure a more cordial feeling between members for the protection of their mutual interests and for the collection and distribution of valuable trade information and to protect them against making unsatisfactory credits. All members are supplied with certain uniform blanks or forms and when a customer of a given member does not respond to the usual demands for settlement of a past-due account, that member, in lieu of sending the claim at once to an attorney for collection, forwards to the delinquent Form No. 1, which calls upon him to pay the amount of the claim within three, five or ten days from date, and states that if it is not done the matter will be handed to the Co-operative Credit Association for attention, but ending with a statement that prompt remittance will render this action unnecessary.

If, after the lapse of the time specified, no satisfactory results have been obtained, since the circular letter No. 1 was mailed, the member sends to the association office Form No. 2, advising the secretary of the name and address of the tardy customer and the amount owing, whereupon the secretary sends Form No. 3, which is the last form, or communication, which the delinquent receives, in which the customer is advised that his name has been reported to the association as delinquent in his payments to a given member named, and also the amount of the indebtedness. He is urged to settle the amount within ten days. This form letter ends substantially as follows: "Should there be any question whatsoever as to the justice of the claim, or as to its being past due, the secretary will be glad if the customer will at once send a full statement of the facts so that the matter may be carefully investigated, as it is not the intention to do an injustice to anyone." Right here, you perceive, that the alleged delinquent is thus granted his day in court. If he is honest and business-like he will at once respond by making payment in whole or in part, or offer a satisfactory reason for deferring somewhat. All answers are carefully considered by the association and no honest debtor has cause to complain, as his rights are safeguarded equally with those of the members themselves. But if this form does not effect a satisfactory settlement of the account within the stated ten days, then, upon written request from the member, and with his permission, the indebtedness is reported to all of the members of the organization in a confidential communication, which simply gives the name of the delinquent customer, his address and the amount of the indebtedness. This information along with about a hundred other names is sent out by the organization twice each week. The form states that the information is strictly confidential and for the exclusive use of the member who is directly interested in receiving same for his credit protection and that it is not intended to impute dishonesty or financial irresponsibility to the customers named therein.

As soon as the account is settled the name is immediately withdrawn and the members are at liberty to sell the party on such terms and extend such credit as they may deem warranted.

Shortly after the first of each month, printed booklets containing about 5,000 names that have been reported to the association for unsettled indebtedness are distributed among the members and all the information that goes forth on the supplemental forms throughout the previous month appears in the book. Those names reported delinquent are added to the book and the names of those who have settled their accounts are taken out, so that the monthly in reality presents the names of customers who have failed to liquidate admitted indebtedness to the members of the association.

The Chicago association is one of the five organizations in the electrical trade carrying on identically the same work, so that the entire United States and Canada are practically covered by the service, and about 450 of the leading manufacturers and jobbers throughout the country are thus co-operating in the exchange of credit facts.

From the statistics at hand the Chicago association has collected for its members during the twelve years that it has been operating, over $2,000,000 of delinquent accounts. The amount settled during the past year exceeds $286,000. The average amount, therefore, collected for the 200 members of the association during the past fiscal year was $1,430. If these accounts had been turned over to an attorney and collected on the usual ten per cent basis the commission would have figured $143; as against this the members have simply paid annual dues to the extent of $30, so this is a net saving to each of them of $113.

The ratio of accounts collected through the association to those reported this year has been seventy-five per cent; last year it was seventy-four per cent, and the year before seventy-seven per cent; the year before that seventy-six per cent. This does not take into consideration the number of accounts that are settled by the use of Form No. 1 simply, of which the association has no record, as this form is sent direct by the member to the customer, but from reports recently received at this office it would appear that Form No. 1 alone effects settlements anywhere from sixty-five times to ninety times out of a hundred, and this, too, without any aid from any collection agency or commissions or fees paid to attorneys.

FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

SYRACUSE RAPID TRANSIT.

The Syracuse Rapid Transit Railway Company's report, as filed at Albany, for the quarter ended September 30, 1908, shows as follows: Gross, $335,648; expenses, $228,023; net, $107,625; taxes, $15,356; operating income, $92,269; other income, $1,095; gross income, $93,364; charges, $90,282; net income, $3,082, a decrease of $34,039, as compared with the corresponding quarter of 1907. Cash on hand September 30, 1908, $41,354; profit and loss surplus, $478,013

CHICAGO & MILWAUKEE ELECTRIC.

The receivers of the Chicago & Milwaukee Electric Railroad report for the month of October and from January 28 to October 31, 1908, as follows: October—Gross, $49,325; expenses, $41,803; net, $7,522. January 28 to October 31—Gross, $468,451; expenses, $330,507; net, $137,944.

Net earnings for October were the smallest of any the current fiscal year, while August, with net of $35,572, was the best.

SCHENECTADY RAILWAY.

Schenectady Railway Company's report, as filed at Albany, for the year ended June 30, 1908, is as follows: Gross, $979,682; expenses, $723,305; net, $256,377; other income, $12,678; total income, $269,055; charges, $125,889; surplus, $143,166, which compares with $196,820 for the preceding year.

CHICAGO TELEPHONE.

The Chicago Telephone Company's earnings for the ten months ended October 31, 1908, are as follows: January 1 to October 31—Gross earnings, $7,211,039; operating expenses, $3,276,878; net, $3,934,161; maintenance and reconstruction, $2,027,533; balance, $1,906,628; dividends and reserves, $1,817,205; surplus, $89,423, as compared with $159,487 for the same period of 1907; average number of stations, 215,562.

President Sunny says: "November marked the turn, however, as is shown by the following: There were installed 4,708 new telephones, or an increase of 488; there were removed 2,397 telephones, or a decrease of 719, making a net gain of 2,311.

"Because of the general business depression, traffic during the year up to November 1 was somewhat less than in 1907, notwithstanding a large increase in the number of stations. Since November 1 there has been a marked and satisfactory increase in the number of telephone connections, a sure indication of a return to normal conditions.

"Telephones installed in the eleven months to December 1 were 59,817, an increase of 2,400; telephones removed were 33,650, an increase of 6,144; a net gain of 26,167, a decrease of 3,744."

Skyscrapers Discussed at Stevens Institute.

On the afternoon of December 3 the students of Stevens Institute of Technology, Hoboken, N. J., were afforded the pleasure of hearing a lecture on the construction of "Skyscrapers," given under the auspices of the Engineering Society.

The speaker was Charles G. Armstrong, the architect of the Singer Building in New York city, and his treatment of the subject was limited more particularly to a consideration of that structure. Starting with a definition for "skyscraper" and the necessity for its erection, Mr. Armstrong immediately digressed to the subject of elevators, clearly pointing out the fact that the modern skyscraper was almost totally dependent for its usefulness upon the modern elevator.

By means of lantern slides the speaker drew a comparison as to size between various noted edifices of the world, and after a brief sketch of the general proportions of the Singer Building began an exposition of how it grew. Especially interesting was the description of that hazardous work necessary in all skyscraper construction on Manhattan Island—the sinking of caissons to bed-rock in order to obtain proper foundations. Special attention was paid to the manner of anchoring the massive tower. In this connection Mr. Armstrong stated that the feet of the tower columns were secured to the foundations in the sub-cellar by stout steel tie rods running down forty feet in the concrete, and that the enormous lifting force of 250,000 pounds per square inch would be necessary to budge a column. Some interesting photographs taken during construction made apparent the danger of the housesmith's occupation.

Turning to a consideration of the structure as a completed unit, the speaker described its various conveniences and luxuries: Costly bronze grille work, expensive marble, elaborate office furnishings in the way of plumbing, ventilation, automatic heat control, vacuum cleaning apparatus, bell and telephone service, etc. A matter of special interest presented, typical of twentieth-century progress, is the elaborate clock system, one master clock in the main hall having control over hundreds of clocks elsewhere in the building.

After a short description of the various safety devices and signal apparatus, shop facilities for repair work, etc., Mr. Armstrong took up the consideration of power. He stated that the Singer Building uses as much power as a moderately sized city—approximately 2,000 horsepower. Boilers, engines and electrical apparatus are of the highest type, securing economy, convenience, and safety adequate to wide possibilities of accident and extremes of load. Mr. Armstrong also described the external lighting system of the tower, used for advertising purposes.

In closing his lecture Mr. Armstrong made an appeal to technical men to take up as a vocation the operation of great power plants and buildings, with the view of improving upon the wasteful methods of running them today. He then presented to the Institute a handsome litho-engraved picture of the Singer Building, eight feet high.

Independent Telephone Men Make a Bid for Long-Distance Service.

An offer has been made to the Chicago City Council Committee on Gas, Oil and Electric Light, by C. H. Moulton, of Indianapolis, president of the International Independent Telephone Association, and H. D. Critchfield, of Milwaukee, general counsel of the association, and president of the Wisconsin Independent Telephone Association, to take over the telephone franchises and properties of the Illinois Tunnel Company. As a companion offer, the Independent companies announced that they would enter into a contract with the tunnel company to connect with its telephone lines inside the city, providing it would agree to establish, within two years, a system of 20,000 telephones in Chicago and extend the system so as to get its share of the Chicago local business.

The Council committee has taken no action on either of these proposals, but in this connection an amendment to the ordinance which would give the tunnel company two years more to meet the requirements of its ordinance was discussed. This amendment would allow the two years' extension on condition that the tunnel company contract with the operators of long-distance lines other than the Bell system for an entrance into Chicago.

MERGENTHALER LINOTYPE ELECTRIC-MOTOR DRIVE.

BY S. H. SHARPSTEIN.

Several years ago Perry Walton, who was then purchasing agent for the *New York Journal,* found that the monthly bills for driving a small number of Mergenthaler linotype machines in the Morgen *Journal* office by electric motors were increasing out of proportion to the amount of work done.

As the *Journal* was buying electricity from the New York Edison Company, Mr. Walton requested that it make an investigation. It reported that the meter was in proper condition. Later the manufacturers of the motors were asked to try to locate the cause for the increased current consumption, and they sent a man who seemingly rectified the trouble.

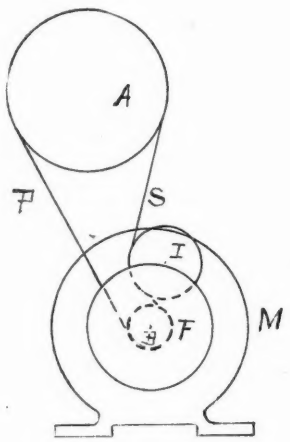
After a little investigation, Mr. Walton found that the motors, which were located in, and geared to, the linotypes, had bearings close to the driving pinions that were supposed to be lubricated by oil feeding from small cups. It was then, as now, customary to lubricate motors by means of ring bearings that would operate at least a week without attention, but special bearings on the motors mentioned above required almost constant attention, or they would run dry and produce excessive friction.

The classes of motors that have been installed in many cases to operate Mergenthaler machines are inferior and have almost driven the managers of newspapers back to the use of shafting drive.

One of the best authorities on printshop practice, a man of long experience with motor drive, advised one of the New York dailies to adopt group drive in preference to individual motors. Group drive was installed with one exception. A Mergenthaler machine that was located on another floor was driven with a late type of electric-motor drive, and the armature of the equipment burned out during the first month that it was in operation.

Individual motor drive has some good features which group or shafting drive has not. One argument in favor of group drive is that the power of the larger motor installed to drive the four or more linotypes has sufficient capacity to maintain the speed when the type-casting device, at times, requires excessive power. This extra demand for power can be met when the individual motor is used by placing a flywheel F on the motor shaft, as shown in the illustration. With group drive, even though the motor be large, the belt running from the shafting to the Mergenthaler may slip, but with a good individual motor rig, under normal conditions it cannot.

Referring to the illustration, assume that A is a driven pulley on a linotype, M a motor installed to drive it by means of a belt. If the pulleys A and B are wide enough to take a good pliable single leather belt of sufficient width to drive the linotype under all normal conditions, B having a flywheel rim F that will produce a momentum to pull the linotype at any time when it requires power above the capacity of the motor, and an idler pulley I be provided to operate on the slack side S of the belt with a spring to compel it to follow up the belt when it happens to stretch, no surer drive can be had when the apparatus is properly designed and constructed.



LINOTYPE MOTOR DRIVE.

With group drive, the shafting is usually placed on the floor near the machine, necessitating a short belt between the pulley on the linotype and the pulley on the shafting. Almost any belt will change in length with the changes in the weather, making it next to impossible to get the best belt-driving conditions where it is so short, without a good idler pulley.

If the idler pulley is of the right diameter to keep its revolutions per minute low, its bearing will not require lubrication when properly made and installed. A slight spring pull that will follow up the belt is of more importance than excessive idler-pulley tension with no spring. A motor of the right design and speed will allow of starting with a switch located in a convenient place, without the use of a starting box.

Where the men operating the linotypes get their pay by the piecework system, they often want the machine to run above normal speed. All individual motors installed to drive such machines should be capable of having sufficient speed variation by inserting resistance in the field winding to give an increase of about fifteen per cent above the normal speed of the motor. It is poor practice to try to get this speed variation by placing resistance in circuit with the armature, which is sometimes done. If there is not some way of easily changing the speed of an equipment, when a motor is used, it is rather difficult to get the proper revolutions, as no two motors of the same capacity and manufacture are apt to have like speeds on the same voltage, and again, the pulleys may be arranged for a certain line voltage which will vary a small percentage.

Good practice demands that a motor, which is to be used to drive Mergenthaler linotype machines, either by being belted or geared direct, or by means of group drive and shafting, should be capable of having its field strength varied sufficiently to allow a speed variation of about fifteen per cent without excessive sparking at the brushes and that it should be supplied with a small field rheostat to be placed, in case of individual drive, where it is easily accessible to the operator, and with group drive near the motor. In the latter case a combination starting box and field regulator would be best.

The Mergenthaler linotype machine is a well-made and expensive piece of apparatus, but for some reason there has seemingly been undue pressure to keep down the price of electric motors used for individual drive. The result is in many cases a large amount of money invested from which the proper returns are not obtained, because cheap electric drive keeps down the production. To be in line with the Mergenthaler and the importance of the work, the electric drive should be the best that motor manufacturers can turn out.

When it is desired to place these machines in scattered positions and not in straight lines, side by side, the use of individual motors is almost imperative. After the use of direct drive is decided upon, the question comes up of supporting the motors from the linotype frame or placing them on a small base on the floor. If the motors are supported from the driven machine, the equipment can the more easily be moved from one place to another, it is easier to clean about the machines, and the motors are not so liable to get dusty. On the other hand, if the motors are placed on neat pedestals, they

are easy to inspect and repair and are not so liable to be in the way when oiling or repairing the linotype. In the above cases it was assumed that belt drive would be used. The belt is often objected to on the point of appearance, but it is a very flexible transmitter for such purposes and allows the motor to be made up of standard parts, which is of the utmost importance to the printer. When the electrician in charge of the motors wishes to make changes or repairs to them, he can do so without interfering with the linotype if belt transmission is used. It is a good machinist's job to get a motor in position so as to make gears mesh properly when once removed.

The speeds of motors for individual drive should be sufficiently low to allow being belted direct to the linotype. Intermediate shafts with their extra belts are not good practice and should never be adopted unless for special reasons. Sometimes direct current cannot be obtained where direct drive is desired. Engineering difficulties might arise in case it was desired to use alternating current, making it advisable to have a secondary shaft on the motor. Especially when individual motors are used, they should be enclosed to keep type metal from getting into them. It is desirable to have the binding posts protected by an iron case, provided with a cover to allow connecting up and testing, and a hole tapped into one side to take a pipe into which the wires are to be pulled.

When group drive is used it is essential to get the linotypes divided up, so that they can be operated to advantage. If, during a portion of the day, only four men are employed at the machines, there should be a one-horsepower motor belted to a shaft to drive the four machines.

It is not economical to have a five-horsepower motor driving a shaft to which twenty linotypes are belted, of which only four are in use. An installation of sixteen machines of this kind is arranged in four groups of four machines each, the motors being placed next to the wall at the ends of the shafting. With this arrangement the equipments look well, the motors are out of the way, the motor starters are placed conveniently on the wall, and the whole electrical equipment is where it is not liable to be tampered with or damaged by careless or mischievous persons.

A one-horsepower motor is sufficiently large for four machines, if they are placed the regular distance apart and the shafting is properly installed with sufficient hangers. A motor that will do one horsepower of work at the pulley for ten hours without more than the usual rise in temperature, can be made to drive more than four machines, but it is wise to have the usual load of the motor below the normal rating, allowing a surplus for times when a bearing may be dry or a belt tight enough to cause excessive friction.

Ordinary shafting practice will not answer for linotype purposes. It usually requires about one-fourth horsepower to drive one of these machines, until the casting apparatus seems to stick, when much more power is required. The main shaft of the linotype, on which is placed the driven pulley, has a very low speed. The result is a low belt travel, demanding a heavy belt for transmitting only one-fourth horsepower. If a contractor installs a line of shafting to transmit power to drive four of these machines at one-fourth horsepower each, when the linotype machinist puts on his belts the shafting is almost pulled from the floor and trouble begins at once. Unless a very heavy shaft is used, in proportion to the work to be done, the floor hangers should be first-class, with ring-oiling devices.

When the linotypes stand side by side, with ordinary distances between them, the belt pull, which is upward, lifts the line shaft up against the top of the box in the hanger. If the ordinary oiling devices for hangers are used, the shafting, being out of reach of them, gets no lubrication, and soon commences to cut out the bearing. The ring oiler running around on the shaft as it turns, carries the oil from the reservoir in the box to the top of the shafting, and with a properly made bearing lubricates the shaft regardless of whether it touches top or bottom of the bearing. Good practice demands a hanger close to the motor pulley and also near each pulley used for linotype drive.

Many electricians who wire electric motors do not seem to understand how to place an idler pulley to keep the slack out of a short belt. At times the idler pulley is put on the pulling side of the belt and set up hard enough to make the belt operate the load, and then the equipment is condemned as worthless.

If the motor-driving pulley is small compared to the driven pulley, the belt should be slack enough to let the idler pulley, which should be on the motor, force the belt to wrap about one-half of the driving pulley, then, if the belt is pliable, there is not much spring tension necessary to keep the troublesome slack out of the belt.

Possibly the best argument in favor of group or shafting drive is the lower cost of maintenance and higher motor efficiency of one large motor as compared to a number of small ones.

If the individual motors are made of standard parts of first-class motors, the maintenance and efficiency will be of small importance compared to the flexibility and reliability of individual drive. All motors will require renewal of brushes and repairs after a time. If a five-horsepower motor should stop, for want of oil or a brush, and put twenty linotypes out of commission, when there was a rush for composition, the expense of the shutdown might cover the small cost of maintenance on twenty good individual motors for many years.

Western Union Dividend.

The directors of the Western Union Telegraph Company have restored one-quarter of one per cent to the dividend rate, which was reduced last summer, by declaring a quarterly dividend of three-quarters of one per cent, payable January 15 to stockholders of record of December 19. This places the stock on a three per cent annual basis, compared with the old rate of five per cent, which prevailed previous to last July 15.

The report for the quarter ended December 31, with figures partly estimated, shows net revenues of $2,000,000, an increase of $1,196,057 over the same quarter in 1907. The surplus, after the payment of dividends and bonds interest, was $820,115, which, compared with last year's deficit for the same quarter, shows an increase of $1,666,235. By combining, the last two quarters of the year show net earnings of $3,864,955, an increase for the six months of $3,372,505.

Commenting on the increase of the dividend for the current quarter, President Clowry said:

"Notwithstanding the setback caused by last year's strike and the long depression which followed, we feel encouraged with reference to our business. We paid one-half of one per cent dividend for the quarters ended June 30 and September 30, or at the rate of two per cent per annum. For the present quarter ending December 31 our estimated net earnings over and above all fixed charges are one-and-one-half per cent, or at the rate of six per cent per annum, and it was deemed best to increase the dividend three per cent per annum."

Electrification of Railroad Terminals Discussed by Steam-Railroad Men.

On the evening of December 11, the Electrical Section of the Western Society of Engineers held a meeting in Chicago for the further discussion of the paper that was read before the main body of the society on December 2, by H. H. Evans, entitled "Developments in Electrification of Railway Terminals." An abstract of this paper appeared in these columns last week.

The discussion was opened by Chairman D. W. Roper, who traced the history of urban transportation and compared the transit means of some thirty years ago with conditions of today. Throughout the days of horse and cable cars, there was a long gap between the length of haul of street cars and of steam suburban roads. The introduction of electric cars caused a decided lengthening of haul and reduced the suburban traffic of the steam roads. The elevated railroads have increased this tendency and brought still greater speed and further inroads on steam suburban service. These factors have brought electrification of this service to the front. Electrical operation permits higher speed than steam. Still higher speeds will be required in future to accommodate the suburban resident who wishes to spend not more than thirty or forty minutes in going to and from his home.

W. B. Storey, Jr., chief engineer of the Santa Fe Railroad, contended that the statement, that electrification of the Illinois Central or other roads is inevitable, is not justified. He does not believe that electrification of terminals in Chicago is feasible or necessary. The smoke nuisance is the only possible excuse for such an undertaking. This is not caused, however, by railroad smoke, but by the smoke problem of the city as a whole. Railroad smoke is only a very small part of the total produced. He does not believe that electrification in general doubles the capacity; it may be that the new terminal of the New York Central may have twice the capacity of the old one on account of extraordinary conditions, special new features and rearrangements aside from electrification, having largely helped to increase this capacity. Mr. Storey contends that the nuisance due to steam operation is insignificant, especially in Chicago. The extra cleaning of passenger coaches is a trifling feature in his opinion. Deterioration of steel work in viaducts is not marked, if these are properly protected. He admits an increase of capacity, due to some dead mileage being eliminated. The railroads wish to have detailed figures given showing the advantages of electrification. The electrification of at least one of the California railroads that were cited was for the object of selling current, as the company bought the road only to use up some of the surplus electrical energy from its large plant; he thinks it was a great mistake. Mr. Evans' statement as to maintenance of electric locomotives being not over three cents per mile, he does not believe to be justified, as the experience with electric locomotives is too short, nor does he believe that electrical equipment is at all standardized as yet. Advocates of electrification should separate their statements about multiple-unit and electric-locomotive operation and give figures for each. He admits that the electrical operation of new heavy suburban lines is warranted, but not the general electrification of terminals. The building of warehouses over tracks is feasible with steam roads also, and, in fact, has been done. He contends that the scheme as to fast and frequent freight service is entirely impracticable, as railroads cannot do what they wish in the operation of freight traffic, but must meet the wishes and conditions imposed by the shipping public. The electrification of the terminals of the New York Central and Pennsylvania railroads in New York city is justified, as it increases their capacity and is necessary in tunnel work. Such conditions are not present in Chicago. It has plenty of room to expand. When economic conditions require it and when definite figures of possible savings are presented, the railroads will be glad to adopt electricity. Where electrification has been adopted in the projects that Mr. Evans cited, it was due to tunnels or special conditions or to governmental experiments, but not due to private corporations voluntarily putting millions into such projects. As to the Illinois Central, he does not believe that the $4,000,000 estimated will be at all sufficient, nor even twice that amount.

W. E. Symons, president of the Pioneer Cast Steel Truck Company, asserted that dust in railroad travel is not caused by steam locomotives, since less than three per cent is due to cinders and soot, most of it being due to air currents caused by the suction of trains. In Chicago over eighty-three per cent of the smoke of the city is caused by other than locomotive chimneys. Damage to property due to railroad nuisances is nil; on the contrary, railroads have enhanced values tremendously. Steam transit is by no means unattractive; the steam locomotive is as fine a piece of mechanism as there is. No reduction of expenses due to wear and tear of rolling stock may be expected from electrification, as this is due principally to switching, and would not be minimized appreciably; it is even now always kept down to a minimum. The standardization of steam-locomotive equipments has not been carried out to a high degree in general, as great variation exists in type of engine and sizes of cylinders and other parts, and since it is almost impossible with diversified management and the conflicting ideas of various division heads as to type of motive power. To show the possibilities in this line, he cited the relatively high development of locomotive standardization on the Harriman lines, with 18,000 miles of railway, where the types have been reduced to five. With the electric locomotive in its present experimental stages, no standardization has been attained, in Mr. Symons' opinion. From the figures on maintenance charges of steam locomotives of three of the largest roads running out of Chicago which he had available, the speaker gave 4.6 cents as an average charge per mile instead of eight to eleven cents, as given by Mr. Evans. He also read extensively from the report of the superintendent of the Baltimore Division of the Baltimore & Ohio Railroad, showing that the maintenance cost of electric locomotives used in the Baltimore tunnel is from three to four times that of steam locomotives. Reduction of track repairs, he thinks, is not important, as eighty per cent of these repairs are caused by the elements, and not by service. In regard to the electrification projects around San Francisco, he spoke of the great traffic handled by the Southern Pacific Railroad during "Fleet Week" last May, while the electric "Key Route" made a dismal failure.

W. L. Abbott said that the steam engineers should wake up from their conservatism to a conception of newer engineering methods. No mention has ever been made by them about the scrapping of steam locomotives on the elevated roads. In Chicago and within 100 miles of it there is more electric than steam railroading. Mr. Abbott told a story about Cornelius Vanderbilt as showing how the railroads are becoming cognizant of the competition of electric interurbans. Considering that sixteen electric terminal projects have been carried out, he contended that the conservatism of the local

railroad officials in refraining from the adoption of electrical methods does not reflect credit on this great city.

W. M. Camp, editor of the *Railway and Engineering Review,* thought that the public agitation of the subject is driving many, including the author of the paper under discussion, to hasty conclusions without proper consideration of actual conditions. Some of these conclusions, in fact, he regarded as far-fetched. For tunnel operation, especially at terminals, electrification is necessary, regardless of cost and possible saving. However, electrification of all terminals does not follow. The railroad smoke nuisance, he thinks, is a bugaboo. He spoke of the dense clouds of smoke over the Chicago Stock Yards and the Illinois Steel Works at South Chicago —no one ever speaks of these. Therefore the agitation about Illinois Central smoke was prejudicial. Experience has shown that we must always expect public clamor about various inconveniences of a large city. Let those who do not like the discomforts of a large city, go back to the country. The electric locomotive is still largely experimental. Conditions in Baltimore and New York are not typical, but special. The operation of the New York terminals has not been perfectly smooth. Many changes have been found necessary as the work progressed. He cited the bad wreck of a double-headed electric train on the New York Central terminal as being due, probably to faulty design of the locomotives. The Pennsylvania Railroad has experimented with various types, and adopted, he believes, a type quite different from the New York Central electric locomotive. He elaborated on the changes made in the New Haven locomotives, particularly the addition of idler wheels on the trucks. Aside from changes in wheel-base design, he cited from Mr. Murray's American Institute of Electrical Engineers' paper (referred to in another column) a long list of changes that had been made in both the mechanical and electrical features. All this shows conclusively that the electric locomotives are not standard, but experimental. So is the line equipment, as shown by the New Haven auxiliary trolley. The whole project, he regards, as still experimental. The railroads do not know yet which is better, the overhead single-phase or the third-rail system. If electrification of passenger terminals is to be brought about, why not that of the freight service, as it causes as much smoke and cinders as the others. For carrying this out an enormous expenditure would be requisite. The statement of maintenance of electric locomotives at three cents per mile is not according to facts. The repairs to armatures will probably be very great in heavy service. Track maintenance, particularly at curves, he thinks, will also probably be greater, due to concentration of weight low down on the trucks.

H. H. Evans closed the discussion by giving a great many data on maintenance costs per locomotive mile that verified his estimate of it as being below three cents per mile. He also gave authorities verifying his statement as to track maintenance. He called attention to the fact that the Baltimore & Ohio electric locomotives were the first electric locomotives used for heavy railroad service, and, in fact, that the service in the Baltimore tunnel was very severe. The entire installation there is twelve or thirteen years old and was in many ways below the standard of good practice of today. There is no doubt that railroads develop property values up to a certain point, when the attendant nuisances become excessive.

Ithaca Section, A. I. E. E.

At the meeting of the Ithaca Section, American Institute of Electrical Engineers, December 11, Prof. H. Wade Hibbard, head of the railway mechanical department of Sibley College, presented a paper on "The Handling of Men." This topic is one of unusual interest, but it is also one that receives comparatively little attention in technical schools.

Professor Hibbard outlined the features of executive work, and pointed out the essential elements of successful co-operation between employers and employes. He advocated courses of instruction in handling of men for undergraduates in technical schools, and instanced the Charlottenburg Technical High School of Berlin as an example. Professor Hibbard has had large experience and many opportunities for observation, and the results of all this were condensed into a trenchant and stimulating paper. The presentation of the paper was followed by a lively discussion.

In view of the fact that the local branch of the American Society of Mechanical Engineers was formed on December 10, a resolution was passed by the Ithaca section of the Institute, extending to the members of the new organization "the best wishes and assurances of hearty co-operation in their work and plans."

Pittsburg Section, American Institute of Electrical Engineers.

The regular December meeting of the Pittsburg Section of the American Institute of Electrical Engineers was held December 8 in the Carnegie Institute lecture hall, with W. Edgar Reed, chairman, presiding. The attendance was 110. The subject for the evening was "Some Experiences in the Use of Gas Engines for Electric Power Generation," an original paper by J. R. Bibbins.

In the discussion the following participated: Prof. W. Trinks, of the Carnegie Technical Schools; W. E. Moore, of the West Penn Railways Company; William Hoopes, of the Aluminum Company of America; C. D. Smith, of the United States Geological Survey; E. B. Tuttle and R. A. L. Snyder, of the Central District and Printing Telegraph Company; J. G. Schroeder, of the Union Switch and Signal Company; W. F. Flint and E. B. McClelland, of the Westinghouse Machine Company, and P. M. Lincoln, W. L. Waters and D. W. Burke, of the Westinghouse Electric and Manufacturing Company.

The subject of electric furnaces will be discussed at the next meeting, to be neld on January 12, at which time an original paper will be presented by William Hoopes.

Franklin, the Telephone Man's Ideal.

In pointing out the value of promptly obtaining and turning over funds, as well as the saving of expenditure, in the operation of a telephone system, Roy Owens, engineer of the Citizens' Telephone Company, Columbus, Ohio, in a paper before the International Independent Telephone Association at Chicago, said:

"It is as true now as in the days of the first man who braved the lightning's current on an insulated line, that 'A quick sixpence is better than a slow shilling.'

"In such a meeting as this I ought not to pass an allusion to Benjamin Franklin without expressing a wish that our engineers might emulate his scientific care, our managers his thrift, our cashiers and contract agents his diplomacy, our spokesmen his strength of expression, our financiers his capacity for persuading funds out of the most unwilling of lenders, and all of us his zeal for knowledge."

Later in the telephone convention a member discussing the application of insurance to telephone properties, brought out the fact that the first insurance company in this country was organized by Benjamin Franklin, of Philadelphia.

REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE

SIMPLE AND PRACTICAL METHOD OF ASCERTAINING THE CHARACTER OF A CURRENT.

In many instances it is of importance to know the character of the current feeding an installation, and in order to ascertain this it is sufficient to approach a magnet to an incandescent lamp fed by the current to be analyzed. If the current is direct the filament will bend each time the magnet is approached; if it is alternating, the filament will begin to vibrate in synchronism with the current and will appear to the eye as a filament of varying thickness. The phenomenon is very distinct and may be made to manifest itself by means of a small magnet that can be carried in the pocket.—*Translated and abstracted from L'Industrie Electrique (Paris), November 25.*

PROFESSOR MAJORANA'S EXPERIMENTS IN WIRELESS TELEPHONY.

The members of the Italian Electrotechnical Association were recently invited by Professor Majorana to witness his experiments in wireless telephony. Professor Majorana has constructed a generator furnishing continuous electrical waves of ten to twenty thousand periods a second. At the transmitting station he employs an arc in a hydrogen atmosphere with a magnetic blowout, the invention of Poulsen, in a Duddell circuit, and a hydraulic microphone invented by himself. A current of about 500 volts and ten to twelve amperes is used in the primary circuit. The operation of the hydraulic microphone, which is connected in the antennæ, between the secondary coil and the ground, is based on the difference in capillary contraction which the liquid column, consisting of a fine jet of acidulated water, undergoes under the influence of the voice. The liquid jet, which is thus continuously modified, presses on two metallic contacts and varies the resistance interposed between them. An ordinary microphone could not be used, as the high-tension currents would burn the carbon grains. As a wave detector the professor uses a thermopile of non-metallic (sulphurous) elements, as he found electrolytic and other wave detectors used in wireless telegraphy unsuitable for the purpose. Experimental stations have been established at the General Post and Telegraph Office in Rome and at Monte Mario, and a third station at Porto d'Anzio, a distance of fifty-four kilometres. The experiments were entirely successful, in spite of a heavy rain and frequent lightning discharges.—*Abstracted and translated from L'Elettricista (Rome), November 1.*

THE KINLOCHLEVEN WORKS OF THE BRITISH ALUMINUM COMPANY.

The British Aluminum Company has completed its 39,000-horsepower aluminum works at Kinlochleven, in the west of Scotland. The company was founded in 1895 to mine bauxite and purify it to aluminum at Larne, in Ireland. The electrodes were prepared at Greenock, Scotland; the reduction was carried on at Foyers, and the metal was worked up at Milton. At the present time the company is drawing its necessary raw material from its bauxite beds in the province of Var, in southeast France, the Irish deposits being kept in reserve. The works at Foyers is capable of developing 7,500 horsepower, and owing to its situation on the Caledonian Canal, communication with the alumina and electrode factories and rolling mills is both cheap and easy. These works have been in operation since the middle of 1896, but is not capable of meeting the rapidly increasing demand for the metal. The company therefore decided to develop the much more extensive waterpower scheme which it had had under its control for some years previously, and early in 1905 a commencement was made with the new works. The company also possesses works at Stangfjord, in Norway, and at Orsieres, in Switzerland, the total capacity of the various works being over 60,000 horsepower. The new development at Kinlochleven is equipped with water turbines of the high-pressure Pelton-wheel type. The whole plant consists of nine large wheels, with an output of 3,200 horsepower each, and two small turbines of 930 horsepower each. There are twenty main generators, each having an output of 1,000 kilowatts at 250 to 275 volts. They are coupled in pairs to the water turbines. All of the generators are of the direct-current, multipolar type, with slot-wound armatures. Each generator is capable of an overload output of 1,100 kilowatts for one hour. The Héroult process for manufacturing aluminum consumes a good deal of carbon, this substance being used in the furnaces and being burned away to carbon monoxide by the oxygen from the reduced alumina. The company has erected a factory for the manufacture of carbon at Kinlochleven, this factory being supplied both for power and lighting purposes by two pairs of aluminum conductors. A railway runs from the factory to the quay at the head of Loch Leven, transporting both outgoing and incoming produce.—*Abstracted from the Electrician (London), December 4.*

NEW APPARATUS FOR WAVE-FORMS.

M. Abraham, a prominent physicist of Paris, who has had considerable experience as an assistant to Professor Blondel in his work on the oscillograph, has devised an instrument which is much simpler and less expensive than the former types, and may be used for obtaining a direct projection of current waves upon a screen. The instrument has been constructed at the Carpentier establishment and consists of two distinct parts, one a special form of galvanometer containing a swinging mirror which is made to follow all the variations of the current; and a second apparatus which is interposed between the mirror and the screen and which serves to spread out the light coming from the mirror so as to give the form of the wave upon the screen. The construction of the galvanometer allows of the production of induced currents in a swinging frame in such a manner that the movement of the latter will follow exactly the variations of the current to be observed. In order to obtain this result an intermediate current is produced outside of the instrument, which is in quadrature with the current or electromotive force to be observed. In the case of an electromotive force a condenser is disposed in series with the galvanometer. For taking the current wave the current is passed through the primary coil of a small transformer whose secondary coil is closed upon the galvanometer. In practice two separate galvanometers are used, placed side by side so as to throw

the two waves upon the screen. The intermediate current is thus sent into the fixed coil of the galvanometer, and this coil acts as the primary of a small transformer whose secondary consists of a short-circuited aluminum frame carrying a concave mirror. The second part of the apparatus, known as the synchronoscope, is used to spread out the beam of light which comes from the oscillating mirror. A revolving prism lies at the center of the synchronoscope and revolves the two beams coming from the two fixed galvanometers. The prism is totally reflecting and is caused to rotate rapidly in synchronism with the wave by means of a toothed wheel of soft iron, which is mounted so as to rotate between the poles of an electromagnet, the latter being connected to the source of current, this combination making a simple and effective synchronous motor. Should the prism be revolving and the mirror in oscillation at the same time, the combined action causes the wave-form to repeat on the screen, owing to the repeated reflections from the three sides of the prism; and the latter therefore gives three reflections of the wave per revolution. In order, however, to secure a better image upon the screen, the light which comes from the prism is not sent directly upon the screen, but is further reflected by a set of fixed plane mirrors which are disposed around the prism. These mirrors are placed so as to be about tangent to a parabola, at whose focus is placed the center of the prism. During the rotation of the prism the beam from each of its faces is reflected upon the four mirrors in succession, and at each reflection the curve is thrown in the same place upon the screen, so that for one revolution of the prism there are twelve successive projections of the wave on the screen. In practice the wave is thus traced as a continuous line of light and the electromotive force and current waves have their proper relative positions.—*Abstracted from the Electrical Review (London), December 4.*

THE APPLICATION OF LOW-PRESSURE STEAM TURBINES TO POWER GENERATION.

In this article J. R. Bibbins states that the entire potency of the low-pressure turbine lies in its ability to use a waste product or to so improve the general efficiency of a power system as to force a thorough consideration of its possibilities and limitations. In the engine the losses due to condensation and re-evaporation on cylinder walls during each consecutive cycle are large. In the turbine there is no cyclic change, and therefore no such losses, comparatively speaking, as a fairly constant temperature and pressure obtain at any given point in the expansion range. In the engine the mechanical friction of the enormous sizes of cylinders necessary to accommodate the lower expansion ranges constitutes an effective barrier. In the turbine the lower pressures may be used with comparative ease and without incurring excessive losses, mechanical or thermal. There are two general classes of service in which the low-pressure turbine finds effective field for application: Class A—Where the supply of steam is intermittent and widely varying in quantity, for example, in rolling mills, in driving steam hammers and in operating hoisting engines. All of these involve the regenerative principle, requiring a careful study of the time element in supply and demand, and generally resolving into a special problem for each individual installation. Class B—Intermittent supply without regeneration. This class embraces central power stations for lighting, traction or factory drive, and may be discussed as a general problem of power extension. A plant of non-condensing engines may be changed over to reduce its water rate from thirty or thirty-five pounds per kilowatt-hour to fifteen or eighteen pounds per kilowatt-hour. In other words, for the same expenditure of coal and water a net increase in power of from eighty to 100 per cent may be realized, depending upon the type of equipment. The resulting cost of power is reduced in the same proportion. From a thermodynamic standpoint the low-pressure turbine is the exact counterpart of the familiar complete expansion turbine and possesses the same characteristics as in the high-pressure turbine. The line of total consumption per hour, or water line, is practically straight, resulting in a constantly decreasing water-rate curve. The low-pressure turbine may be regarded as the third cylinder of a triple-expansion system and is equivalent to such a cylinder fitted with a fixed cutoff. A typical example of a low-pressure turbine application is found in the plant of the United States Coal and Coke Company at Gary, W. Va., operating the mining property, serving hoists, pumps, blowers, lights, etc. The low-pressure turbine has carried a little less than half the total load, which was 2,600 kilowatts, on less than twenty-six inches vacuum, and would have carried over 1,500 kilowatts on twenty-eight inches vacuum with better condensing conditions, giving a probable water rate for the engine-turbine plant of approximately 18.5 pounds per kilowatt-hour. Water-rate curves taken on this plant show that the two Corliss engines give an economy of 20.05 pounds per kilowatt-hour condensing and 28.8 pounds per kilowatt-hour non-condensing for a normal load of 1,000 kilowatts in each case. But in combination with the turbine a maximum water rate of 15.8 pounds per kilowatt-hour is secured.—*Abstracted from the Electric Journal (Pittsburg), December.*

THE PRODUCTION OF CAST-IRON IN THE ELECTRIC FURNACE AND IN THE BLAST FURNACE.

An investigation to ascertain whether the production of cast-iron in the electric furnace would in some cases be more economical than in the blast furnace was made by Engineer Remo Catania, and the results were communicated to the Italian Electrotechnical Association at its recent annual meeting. A definite comparison has so far been impossible, as the blast furnace must also be considered as an enormous generator of motive force, and as there are no data available relative to the gas developed by the electric furnace. The largest blast furnaces reach an output of 800 tons a day; electric furnaces producing eight kilograms of cast-iron per horsepower per day would consume 800,000 horsepower. In comparing the two processes one must take into account not only the amount of material introduced into the furnaces, but also that taken from them. In the absence of data concerning the amount of gas obtainable from electric furnaces the author bases his calculations on chemical equations, applying the same method to the electric furnace that has been applied to the blast furnace. The conclusion arrived at is, that in a country where coke costs forty lire per ton the manufacture of cast-iron in the electric furnace will be cheaper than in the blast furnace, if for a production of eight, ten and twelve kilograms per horsepower per day the cost of electric current per horsepower year is, respectively, sixty, eighty and 100 lire, and assuming a complete, rational and direct utilization of the gas in gas engines and not under steam boilers and in steam engines.—*Abstracted and translated from Elettricista (Rome), October 15.*

INDUSTRIAL SECTION

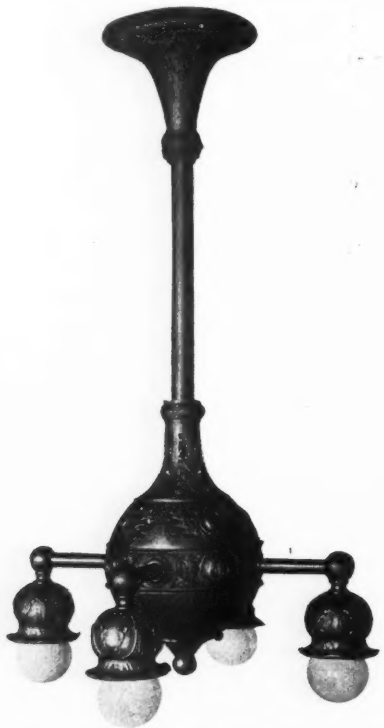
ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

New Westinghouse Nernst Chandeliers.

Besides establishing a great economy in the price of light of the best quality, the new Westinghouse Nernst lamp is responsible for the development of a line of chandeliers that give a greater volume of light for a small light source than it is possible to get with any other incandescent chandeliers ever made, says the manufacturer.

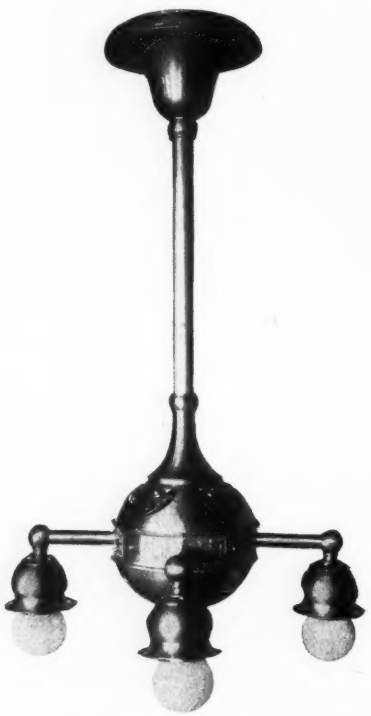
These chandeliers now being put on the market are made in highly artistic designs in the renaissance and art nouveau styles. They are made in solid castings or in a combination of castings and spinnings and finished as standard in statuary bronze and satin brass.

A novel feature about these chandeliers is the arrangement of the mechanism of



NEW FIXTURES FOR WESTINGHOUSE NERNST LAMPS.

the lamps in the central ornamental ball which conceals it completely and at the same time makes it easily accessible. This leaves nothing at the ends of the arms except the small screw-base burners, and these occupy less space than any other incandescent lamps of equal candlepower. The 132-watt burner, for instance, giving light equivalent to that of seven sixteen-candlepower carbon-filament lamps, occupies a space at the end of the arm of only three by four and one-half inches. This makes it possible to get a large volume of



NEW FIXTURES FOR WESTINGHOUSE NERNST LAMPS.

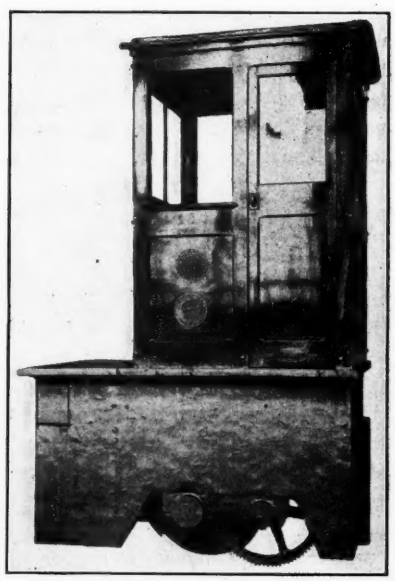
light without using a multiplicity of sources or infringing the law of proportioning by making the sources too large for the other parts of the chandelier.

Electrically-Driven Turntable.

For doing work of a purely laborious sort, requiring mere strength, the human animal is a very inefficient piece of apparatus when compared with such mechanical power devices as electric motors—inefficient, indeed, in point of size, weight and cost of operation. Nevertheless, it has long been almost universally the custom to operate turntables and transfer tables on steam railroads by man power. A striking example of the economy and convenience which results from the use of electric power for this service is shown by the installation of a motor on a turntable on one of the railroads in New York state.

This turntable was formerly operated by hand, requiring the time of a number of men at intervals, which averaged the continuous service of two men for twenty-four hours a day. The donkey was then equipped with a standard type F, high-torque Westinghouse induction motor, rated at twenty horsepower, and using sixty-cycle, two-phase current at 200 volts. This reduced the labor required to one man per day of twenty-four hours.

Inasmuch as the men were paid fifteen cents an hour in each case, this motor made a saving of $3.60 a day, or $1,314 per year of 365 days. As the cost of power for the motor has averaged but $8 a month, or a total of $96 a year, the net saving is $1,218 a year. The total cost of the electrical equipment, including the cost of installing the outfit, was approximately $1,500, which is but slightly greater than the actual saving in one year. As a result of this installation four other turntables have been supplied with elec-

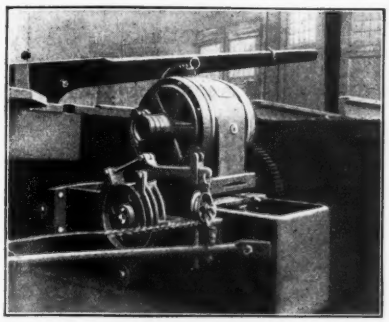


CAB AND GEAR CASE OF MOTOR-DRIVEN TURNTABLE.

trical equipment by the same railroad, and plans are on foot for equipping several more similarly.

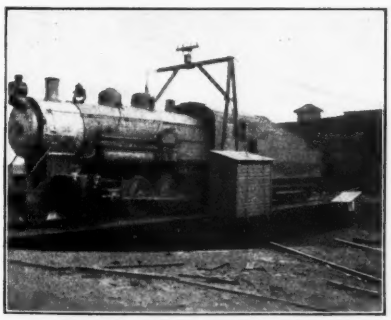
The economy is not the most important point among the advantages of the electrical equipment, although it makes a very good showing. The work of a turntable is intermittent and is usually rushing for

a short time and then at a standstill, especially at terminals, where many locomotives often come in at the same time. The length of time required to turn a locomotive by hand depends largely upon the number of men available to do the turning, but even with the handles full (which condition requires from four to eight men), it is impossible to do the work as rapidly as with a motor. Hence the saving in time at such periods is of great importance, as the congestion at the turntables is relieved and the movement of traffic is expedited.



DRIVING GEAR ON MOTOR-OPERATED TURNTABLE.

The method of supplying power to the table has some interesting details. A bridge is used with overhead wires, which run to a standard Westinghouse overhead collecting switch. This switch is constructed with brushes and collector rings, so that contact is made at all times and in all positions of the turntable. This switch is so constructed that there is no strain on the line wires, as the cross-arm to which they run does not move with the tables, but is stationary while the table revolves.



LOCOMOTIVE ON MOTOR-DRIVEN TURNTABLE.

In this installation the cab is mounted on the center of the turntable, so that the wires run directly from the bridge to the cab and to the motor. In many instances the cab is mounted at one end, but instead of being directly on the table, it is mounted on the donkey directly over the motor, to overcome the jolting which the cabman would get when the locomotives run on and off. The type of cab which the Westinghouse company has adopted as a standard for this work is shown in one of the accompanying illustrations.

In many cases, especially in a new installation, the feed wires are run underground in conduit and brought up through the king-pin in the center of the table. The same type of switch mentioned above is placed between the tracks, and the connections made from this point in the usual manner.

New Self-Starter for Induction Motors.

A distinctive feature of the new line of self-starters for alternating-current induction motors recently placed on the market by the J. L. Schureman Company, Chicago, is the use of solenoids to perform the various functions of the starter, thus corresponding closely to direct-current practice.

The accompanying half-tone illustration shows the simplest type of these starters, one designed for small motors, capable of being thrown directly across the line to start. It consists of a solenoid-operated switch for closing the motor circuit, together with a small relay, which makes possible reducing the amount of current in the control circuit to a minimum. All parts are mounted on a single slate panel with front connections, and legs for bolting to a vertical surface, making a neat, compact outfit, easy to install and mount.

The main switch is closed through a crank action, which requires very little power to operate, and permits the use of a solenoid of moderate size. No toggle joints are used. The circuits are made and broken on heavy carbon and copper "butt-end" contacts, which can be cheaply and easily replaced, and are very easy of adjustment

The operating solenoids are of a noiseless type and carry current continuously while the starter is in running position. This provides the no-voltage release feature, and in case of a failure of voltage from any cause the starter returns to the "off" position, disconnecting the motor from the line. The current consumed by the solenoids is only a fraction of an ampere.

The usual method of control is from remote push-buttons or by means of a pressure or vacuum regulator. Three small wires are run to the point of control. To start, momentary contact between wires 1 and 2 closes the circuit of the relay, which in turn actuates the main-line switch, connecting the motor to the line. Momentary contact between wires 1 and 3 short-circuits the relay coil, and the circuit to the main-switch coil is broken. The opening of this switch then disconnects the motor from the iine.

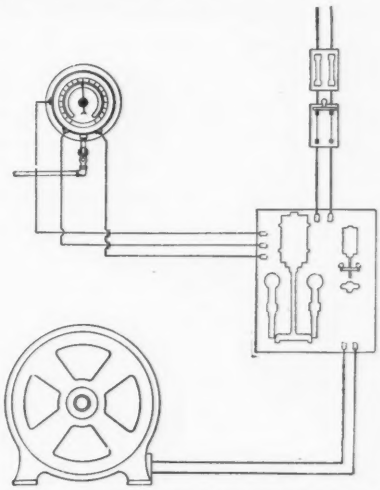
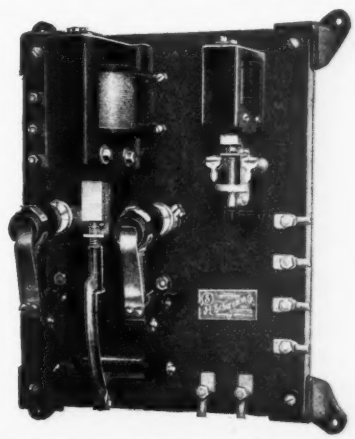


DIAGRAM OF CONNECTIONS FOR SCHUREMAN TYPE AC STARTER, WITH PRESSURE REGULATOR AND SINGLE-PHASE MOTOR.

The relay, when closed, completes the circuit of its coil, so that current is carried by the control circuit only at the moments of starting and stopping. As both the starting and stopping operations are performed by making contact, no current is broken in the control circuit, eliminating arcing on the control switches.



SCHUREMAN ALTERNATING-CURRENT TYPE AC STARTER.

This type of starter finds its widest use in connection with vacuum-cleaning plants using remote push-button or vacuum regulator control and in connection with small air compressors or fluid-pressure pumps. On pump and compressor installations it is used with pressure-regulator control, starting and stopping the motor on the desired limits of pressure.

Westinghouse Company Reorganized.

The Westinghouse Electric and Manufacturing Company has again become the property of the stockholders, after having been in the hands of receivers since the 23d of October, 1907. As stated in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN last week, the petition for the discharge of the receivers was made on December 5 in Pittsburg, Pa., before Judge Young, of the United States District Court, and was immediately signed by him. The petition was presented by G. B. Gordon, attorney for the receivers and for the Merchandise Creditors' Committee; Paul D. Cravath, attorney for the Stockholders' Committee, and A. H. Larkin, attorney for the Readjustment Committee. Mr. Gordon made the address to the court, in which he gave a statement of the company's affairs prior to the receivership, explained the causes which led to the establishment of the receivership, presented a report of the operation of the company during the tenure of the receivership, and finally led up to the great work which has been accomplished within so short a time by Mr. Westinghouse and the various committees in bringing about the rehabilitation and reorganization of the company. He emphasized the fact that during the year the receivers had been in charge they had not only succeeded in paying off the interest on bonds as it fell due from time to time, but that they also kept the large factories of the company in operation during the entire time, doing an excellent business at a net profit of over $1,000,000.

The action of 5,000 employes in subscribing for $600,000 of stock of the company was another feature presented to the court, which made a great impression, because it demonstrated the amount of confidence the employes themselves had in the company. It was also brought out that the company, under the reorganization, would in every way be in a better condition than at any previous period in its history, as it would start upon the new regime with cash on hand amounting to upward of $15,000,000, with an indebtedness of only about $200,000. Mr. Cravath, in addressing the court on behalf of the stockholders' committee, stated that, in the annals of receiverships, this one stood without a parallel as the most successful.

The board of directors, which consists of George Westinghouse, E. M. Herr, James S. Kuhn, Joseph W. Marsh, William McConway, J. L. Callery, Richard Delafield, Albert H. Wiggin, Charles S. Brooker, A. G. Becker, Charles A. Moore, Edwin F. Atkins, Neal Rantoul, E. C. Converse, Anthony N. Brady and George Verity, held a meeting in New York on December 7 and organized as follows:

President, George Westinghouse.

Temporary chairman of executive committee, E. C. Converse.

First vice-president, E. M. Herr.

Second vice-president, L. A. Osborne.

Acting vice-presidents, G. W. Hebard and W. M. McFarland.

Secretary, Charles A. Terry.

Treasurer, T. W. Siemon.

Assistant treasurers, E. St. John and H. F. Baetz.

Auditor, J. C. Bennett.

Allis-Chalmers Business.

A representative of the Allis-Chalmers Company says business is steadily increasing. The bookings of the company during November were eighty per cent greater than during November, 1907, fifteen per cent above October, and October was sixty-five per cent ahead of September.

Few of the orders were of large size, but they are of a character that suggests that the industrial companies are entering a new era of spending money on small additions and on replacements.

The machinery furnished to the mining and ore-treating companies is of very respectable volume and is increasing steadily.

Turbines and high-pressure fire-fighting apparatus forms a large part of the company's business, and orders for the former and investigations of the performances of the latter are being secured in very gratifying numbers.

A large contract for the construction of a tie-preserving plant for the Pennsylvania Railroad Company was recently secured and is the first installation of a plant of this kind by an eastern trunk line.

A New Rectifier.

An alternating-current rectifier invented by two instructors of the Massachusetts Institute of Technology, Harold G. Crane and Waldo V. Lyons of the Electrical Engineering Department, is now being tested with the purpose of perfecting it for the market. The rectifier has been found satisfactory for such use as the charging of storage batteries, and its economy is declared to assure the success of the new converter.

Auto-Starters for Squirrel-Cage Motors.

It is the usual practice in all squirrel-cage induction-type motors of greater than five-horsepower capacity to employ a starting device of the reactive type, usually termed an "auto-starter," or "starting compensator," the object being to limit the rush of line current according to the load demands. The selection of this device is a very important matter, since even a good motor may be unsatisfactory in starting characteristics if equipped with a poor auto-starter. In fact, excellence in design and construction in any motor may be nullified, in so far as starting characteristics are concerned, unless an auto-starter of proper design is provided.

The auto-starter, made by the Wagner Electric Manufacturing Company, St. Louis, Mo., and shown in the illustrations, is a strong and attractive feature of the motor equipment. In its design and construction no thought or experiment has been spared to produce a practical and effective motor-starting device having the maximum durability.

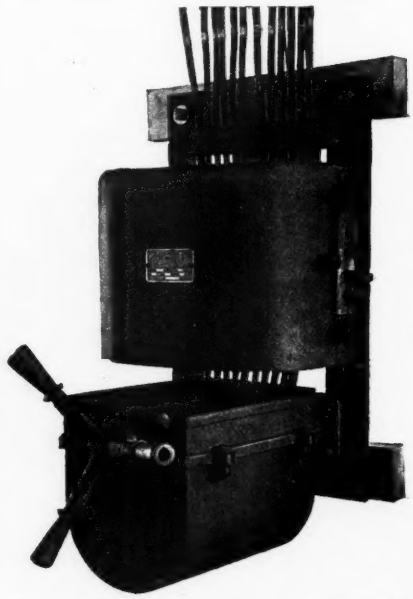


FIG. 1.—WAGNER AUTO-STARTER COMPLETE.

The auto-starter consists of two elements, a transformer enclosed in one iron case, and a switching device enclosed in another case which is oil filled. Brought out from the transformer are a number of sub-voltage taps, giving different percentages of full voltage, and from which any desired tap may be selected for permanent wiring to the switching device, after one or two trials under actual service conditions.

The switching device, as will be noted

from an inspection of Fig. 2, which shows the interior, is of the horizontal-shaft drum type, with the mechanism immersed in oil. A quick-make-and-break cam eliminates all possibility of arcing between the working contacts. In starting the motor, the handle is moved always in the one direction. It may be turned back to the "off" position only from the first starting position, and after once passing the first starting position it cannot be returned to "off" except by going through all of the succeeding positions. The connections for the successive positions are as follows:

In the "off" positions the transformer and motor are both dead. Upon turning

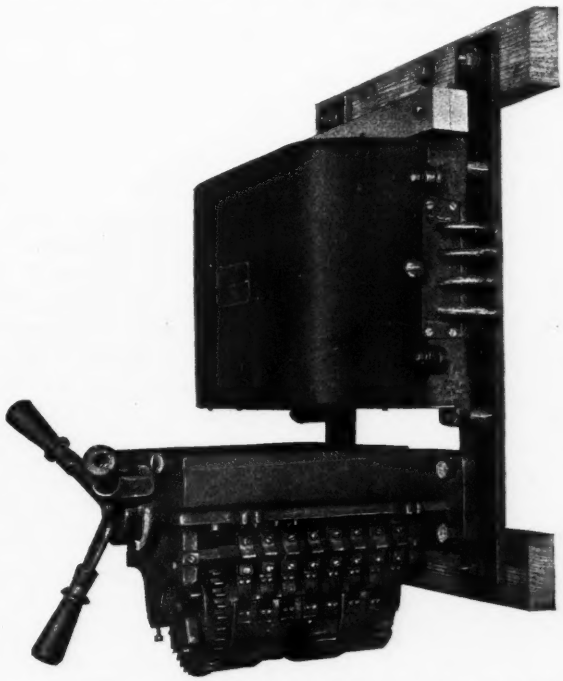


FIG. 2.—WAGNER AUTO-STARTER WITH OIL TANK REMOVED.

the operating handle into the first starting position the motor is connected to the sub-voltage tap of the transformer, with the fuses short-circuited. The connections thus established cause the compensator to deliver sufficient pressure to start the motor with a minimum of line disturbance. Turning the handle to the second position connects the motor to the full voltages and disconnects the transformer, the fuses being still short-circuited. Finally, in the third or full running position the fuses are cut into the circuit.

The advantages are enumerated as follows:

1. Fuses are short-circuited at starting and first running positions.

2. Transformer is alive with switch upon first starting position only.

3. Motor is disconnected with starter in off position.

4. Motor obtains any desired percentage of voltage according to starting requirements.

5. All make-and-break contacts are of the sliding type and oil immersed.

6. Points of making and breaking of circuit on the drum are separate and renewable.

7. The actual contact points are renewable.

8. All connections are made and broken quickly.

The complete device is of the unit system, a switch and a transformer, and may be arranged to meet best the conditions at the point of installation. The starter is identical as shipped for two or three phase work.

Westinghouse Fixed Charges.

The liability statement of the Westinghouse Electric and Manufacturing Company, as contained in the receivers' report, shows that there are outstanding approximately $36,000,000 bonds and other forms of interest-bearing notes, on which the fixed charges are approximately $4,000,000 a year.

The largest item in this total comprises the five per cent convertibles of $22,135,000. The next in importance is the three-year, six-per cent collateral notes, due August 1, 1910, of which $6,000,000 are outstanding. These latter would seem to be among the earliest obligations to invite retirement, because of the high rate of charge upon them. It is noteworthy also in this collection that the amount of cash on hand on December 4 was greater than one-quarter of the entire outstanding bonds and notes on which fixed charges are reckoned. This does not include $1,525,000 of special cash deposits noted in the receivers' balance sheet.

A FINE STREET-LIGHTING INSTALLATION AT WEST AURORA, ILL.

BY W. R. BONHAM.

The West Aurora Improvement Club, of West Aurora, Ill., which was organized about three months ago for the purpose of improving the business section of the city, has completed its first installation of electric street lamps, and the turning on of the current was an occasion of considerable importance.

It was decided to install multiple tungsten lamps on artistic iron posts, fifteen feet high, and carrying two side-arms, each supporting 100-watt tungsten lamps, at about twelve feet from the ground. A sixty-watt tungsten lamp is placed on the top of the post, and the lamp sockets are supported by the cable conductors, which extend about two inches from the iron support. This method obviates a shock being transmitted to the lamp in case the post should be struck by a passing vehicle. Clear lamps are used, with an eight-inch opalescent globe placed over the lower lamp, and a ten-inch globe over the upper lamp. The posts are placed fifty feet apart, exactly opposite on each side of the street. At street crossings a four-arm post is used.

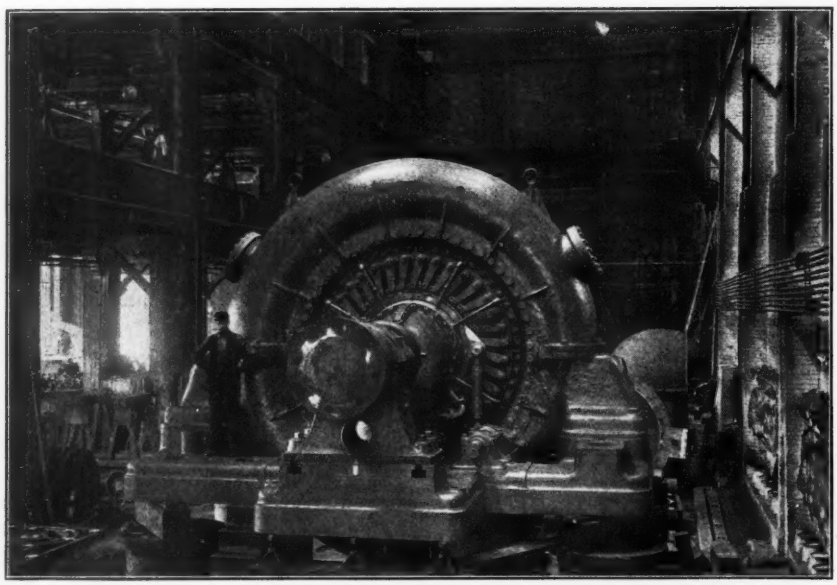
All wires are run in underground conduits, and in the purchase of material and installation, local firms were favored wherever possible. The lamps were purchased from the Sterling Electrical Manufacturing Company, of Warren, Ohio. The installation includes seventy lamp-posts, eight of which carry four cross-arms, and the balance two, providing for 226 lamps. During the entire installation only one lamp suffered breakage, which greatly increased the confidence of the purchasers in the stability and reliability of the tungsten unit.

The president of the club formally presented the installation to the city of West Aurora, which will now maintain it. The acceptance was made by the mayor, and when the current was finally switched on, the greatest satisfaction was manifested.

Two 8,500-Horsepower Allis-Chalmers Water-Wheels for the Telluride Power Company, Grace, Idaho.

In the new waterpower development at Grace, Idaho, of the Telluride Power Company, there are installed two 8,500-horsepower Allis-Chalmers Francis-type water-wheels with double-discharge end horizontal shafts.

The turbines are supplied with water by means of a penstock or pressure pipe five miles long, under approximately 450 feet head, and are required to drive two 5,500-kilowatt, sixty-cycle alternators, whose power at 40,000 volts will be transmitted nearly 150 miles and delivered near Salt Lake City to the electrical distribution system of the Telluride Power Company in Utah.



8,500-HORSEPOWER DOUBLE-DISCHARGE SPIRAL-CORE HYDRAULIC TURBINE, TELLURIDE POWER COMPANY.

Each turbine, when operating at 300 revolutions per minute with an effective hydraulic head of 450 feet, delivers 8,500 horsepower at an efficiency of eighty-four per cent. These units are of the Francis type and consist of a horizontal main shaft carried by two bearings, and a single central casing surrounding a twin runner controlled by a service or "vane" type speed-gate and discharging in opposite directions into two separate draft tubes, all united and supported by an ample bedplate.

Spiral or scrolltype casings of cast-iron are used with horizontal bottom inlet. The vane shafts are hollow and fitted for forced grease lubrication at both bearings. The runners are of the twin or double-discharge type, and designed to be balanced under running conditions. The draft tubes below the level of the bedplate are constructed of concrete. The units described are computed to fit the following data: Fall acting on wheel, 450 feet; power at full gate opening, 8,500 brake-horsepower; speed, 300 revolutions per minute.

Electrical Projects on the Pacific Coast.

A number of new corporations have filed articles in the Coast states during the last few days. At Los Angeles, Cal., the Consolidated Reservoir and Power Company has been incorporated with an authorized capital stock of $1,000,000, by H. E. Moore, A. E. Poole, G. I. Lamy, William Lane and others. In Portland, Ore., Goodwin A. Young, Ray W. Lang and N. A. Peery have incorporated the Columbia Railway, Light and Power Company, with a capital stock of $50,000. In Nevada, the interests that are planning to distribute electricity throughout Rhyolite and the neighboring mining camps have organized as the Rhyolite Electric Company, with W. D. Hatton, C. A. Stoible and M. J. Hill of Goldfield, as directors. In San Francisco, the only new incorporation of an electrical nature is that of the Shoenberg Electric Appliance Company, which has a capital stock of $25,000, and of which the organizers are S. G. O. King, S. J. Goldman, M. Shoenberg and H. Shoenberg. The Snow Flake Gold Mining and Power Company has been organized at Salt Lake, Utah, by mining interests in the vicinity of Modena, Utah.

The Griffin Enclosed Gas Engine.

A two-cylinder, three-cycle, enclosed engine has recently been constructed by the Griffin Engineering Company, Limited, of the Kingston Iron Works, Bath, England, designed with a special view to the employment of suction gas as the working agent. This engine possesses a number of original features. By arranging for a scavenging stroke after each explosion, Mr. Griffin is able to use a low compression, and yet get a richer mixture in his cylinder than is possible with even high compressions used with high-speed engines running on the Otto cycle. He claims that he thus combines a low compression with a low consumption of gas per brake-horsepower. The scavenging stroke tends to increase the internal resistance of the engine, but this is compensated for by the use of a special double valve for controlling the supply of gas and air.

Another special feature of the engine is the use of low-tension magneto ignition, a single oscillating magneto firing the charge in both cylinders. Mr. Griffin employs electrical means of breaking the contact, with the result that the magneto used can be fixed at any convenient point of the engine instead of having to be placed in a position giving a straight lead from it for the links to the contact-breaker. Any number of cylinders can, moreover, be fired from the one magneto.

Salt River Reclamation Project.

The Salt River Reclamation Project, involving the construction of the great Roosevelt Dam at Roosevelt, Arizona, is now seventy-four per cent complete, announces the *Reclamation Record*. About 8,500 cubic yards of masonry were laid in the Roosevelt Dam during November, bringing the lowest part of the structure to an elevation of sixty-five feet and the highest part thereof to an elevation of eighty-five feet. About forty-eight per cent of the masonry of the dam had been laid at the close of November. The cement mill, with two kilns running on an average of twenty-one days each, burnt 9,800 and ground 9,500 barrels of cement. The transmission line is completed into Roosevelt, and the setting of poles and stringing of wire is in progress near Phœnix. The foundations for the towers for the Salt River crossing near Tempe are being built. The walls and roof of the switching station are completed. Good progress has been made in the excavation of the South and Grand Canals.

Current Electrical News

CONTINENTAL EUROPE.

(Special Correspondence.)

PARIS, DECEMBER 5.—The telegraph department of France has adopted a new measure which will be greatly appreciated by the public. Starting December 1, steps have been taken to allow the public to send telegrams, in cities where there is a night service, at the greatly reduced rate of one centime (one-fifth of a cent) per word, with a minimum amount of ten cents in any given case. Thus for 10 cents it is possible to send quite a letter containing fifty words. The messages are sent during the night and are delivered in the first mail of the morning. This "letter-telegram" system was approved by the parliamentary postal and telegraph commission about six months ago. The telegraph rates can be paid by placing postage stamps on the telegram.

A French scientist, M. Louis Paris, has succeeded in producing an artificial sapphire by using the heat of the electric arc. Already the ruby has been formed at a high temperature, but for making the sapphire many difficulties were connected with the operation. Alumina and cobalt oxide are melted together, the latter giving the yellow color, and mixed with a small percentage of lime and magnesia. The result is a stone which cannot be distinguished from the natural sapphire except by the microscope.

Line No. 4 of the Paris Metropolitan subway, which runs from the Clignancourt to the Orleans Gates, is expected to be finished during next summer. This work was delayed on account of the large amount of caisson construction needed for the tunnel under the Seine. One-half of the present subway, running northward from the Seine, is now open for regular traffic. Line No. 6, running from Place d'Italie to Place de la Nation, will be delivered to the Metropolitan company by the contractors in February or March of next year. A rolling incline is now being installed in one of the subway stations in the city as an experiment, as in some cases the tunnel lies at a great depth and the public complain of having to mount the staircases. For the same purpose electric elevators will be tried at another of the stations.

We learn that the Nobel Prize for Physics is to be awarded to Professor Lippmann for his work in the photography of colors. It will be remembered that he is also the inventor of the capillary electrometer, which is one of the most sensitive known, and has carried out other researches in the electrical field.

In order to facilitate the exchange of international telephone messages an agreement has been made between the French and the Italian departments by which a person in Paris, for instance, can be informed by telegraph that someone in Rome wishes to telephone him and that he is to take the message in a certain telephone booth at the designated date and hour. Such telegrams are sent at a reduced rate. A. DE C.

GREAT BRITAIN.

(Special Correspondence.)

LONDON, DECEMBER 4.—An extensive system of street lighting by means of metallic-filament lamps is now under the consideration of the Marylebone (London) Borough Council, in substitution for the present lighting by gas. On the contrary, it may be reported that the City of London Corporation has given facilities to the Gas Light and Coke Company to carry on an experiment in public lighting in the well-known thoroughfare of Fleet Street, by means of inverted, high-pressure gas lamps.

Although reciprocating engines were installed in the first portion of the Greenwich Tramways generating station of the London County Council, turbo-generators have been adopted for the second portion which is now building. The tenders for two 5,000-kilowatt steam turbo-generators have just been received, and it is interesting to note that the British Westinghouse Company has received the order at $204,000, the turbines being of the Rateau type. There were lower tenders than the accepted one, and in order to satisfy the Highways Committee as to the working of this type of turbine, the company took the tramways officers of the Council for a trip to Milan.

The Institution of Electrical Engineers is about to lose its secretary, Mr. G. C. Lloyd, who has held his position since 1904, on the death of Mr. W. G. McMillan. Mr. Lloyd has been selected for the post of secretary of the Iron and Steel Institute, where he was assistant secretary prior to 1904.

The recent fire on the City & South London electric tube railway has awakened the fire brigade committee of the London County Council to the fact that several improvements could be made to the fire-extinguishing apparatus on electric railways. Accordingly, they have reported that periodical inspections of the apparatus should be made by the chief fire officers, that the railway company should provide illuminated signs both on the platforms and on the street level showing when the current is switched on, or off, the live rail, and that in the event of a fire, the fire brigade should be sent for. Hitherto, there has been a rule that the railway employes should themselves cope with a fire on a tube railway.

Hitherto, the National Telephone Company has been assessed throughout the country, for taxation purposes, at a certain rate per mile of wire. The company has now, however, accepted the principle of being taxed according to the earning power of its undertaking in the various districts. This will add considerably to the ratable value in many districts, as much as fifty per cent in some, and in a few quarters this is popularly regarded as a satisfactory retaliation for the imposition of the new rates of charging by the company, which have, in the main, turned out to be an increase over the old rates. G.

EASTERN CANADA.

(Special Correspondence.)

OTTAWA, DECEMBER 12.—Application is being made to the Ontario Legislature for an act to incorporate the Eastern Ontario Electric Railway Company. It is proposed to run from Cornwall to Toronto, with a branch from Ottawa to Brockville. Permission is sought to issue bonds at the rate of $25,000 per mile.

The Municipal Council of Brockville, Ont., has entered into an agreement with the Bell Telephone Company, covering a five-year period, by which the company pays the corporation $500 a year rental for the use of its streets and fixes the rate for business telephones at $30 and residence telephones at $25 per year.

It is expected that the city of Peterboro, Ont., will shortly approach the Hydro-Electric Power Commission with regard to electric power. It is proposed to obtain this, if possible, from sources about twenty miles north of the city, and practically the same plan has been worked out as at Ottawa. About 8,000 horsepower will be used by the city at present.

The Sao Paulo Tramway, Light & Power Company, the Brazilian concern owned and operated by Canadian capitalists, has increased its dividend rate from nine to ten per cent per annum. This action was taken by the directors at Montreal last week, when a quarterly dividend of two-and-one-half per cent was declared. The history of the Sao Paulo company, from five-and-three-fourths per cent in 1903, has been one of constantly increasing dividends.

In an official statement issued to shareholders, the Dominion Power and Transmission Company, which owns the street railway and controls all the electric suburban lines entering the city of Hamilton, Ont., explains that one of the chief reasons that the payment of dividends on the stock is suspended is on account of the depressing effect that the Ontario government's power project has had on the sale of securities. The company has to spend $500,000 reconstructing the street railway, but found it almost impossible to sell the securities, and dividend payments have been stopped until the amount is accumulated. Mr. Geo. Blanchard, vice-president of the company, an American street-railway expert, has severed his connection with the company.

It is estimated that the interests which are working to have the Mexican Power-Tramway lease put through, control and have proxies for 110,000 shares of the power company's stock.

The city of Brantford, Ont., will vote in January on debentures for the purpose of establishing a municipally-owned light and power plant. W.

IMPORTANT DEVELOPMENTS.

PLANS TO ILLUMINATE STATUE OF LIBERTY IN NEW YORK HARBOR—Chief Engineer Armstrong, of the Singer Building, of New York, has been in Washington to interest congressmen in a plan to light up the statue of the Goddess of Liberty in New York harbor as the Singer tower is lighted. The plan is to have twenty-four powerful searchlights, situated at the base of the statue, trained on the statue during the night.

ELECTRICITY TO LIGHT THE PYRAMIDS OF TEOTIHUACAN—The representatives of the Mexican Light and Power Company have offered to follow the suggestions made by the president of the republic regarding the furnishing of electric energy for lighting and power purposes in the camping grounds and installations established in the pyramids of San Juan Teotihuacan. To that effect a committee of engineers has been appointed to make a survey in the district of Texcoco to learn whether the owners of private properties within that jurisdiction

could establish pumping plants for irrigation purposes, and if the water can be economically used from that place, so as to make the establishment of a central supply of electric energy feasible, the company will undertake the work.

NEW YORK, NEW HAVEN & HARTFORD TO START ON $30,000,000 ELECTRIFICATION—Contracts involving $30,000,000 of improvements by the New York, New Haven & Hartford Railroad, have been arranged for. The railroad is to electrify a six-track line from New Rochelle to One Hundred and Twenty-ninth Street. A tunnel will be built under the East River to Astoria, thence to Long Island City, with another East River tunnel and subway to a huge passenger station to be erected on the block bounded by Fourth and Lexington avenues, Thirty-second and Thirty-third streets. The trackage from Astoria to Long Island City may be underground or may be elevated. A connection with the Pennsylvania will be made in Long Island City, according to the report, and a New York, New Haven & Hartford terminal station will be built on the old Park Avenue carbarn site. This would permit passengers from Boston to pass through New York for the West and South without leaving the train.

ELECTRIC LIGHTING.

(Special Correspondence.)

ST. JOHN, N. D.—Horace Bourassea is constructing an electric-light plant at St. John.

RUSHVILLE, NEB.—D. W. Ferree contemplates installing an electric-light plant at Rushville.

MURRAY, IOWA—A special election will be held at Murray to determine upon lighting the streets with electricity. C.

NORWALK, CAL.—J. R. Gordon has been awarded a franchise for an electric-lighting and power system in the town of Norwalk. A.

WEBB CITY, MO.—An explosion badly damaged the plant of the Independent Power Company, at Webb City, killing one employe.

NEZ PERCE, IDA.—E. G. Ousterhaute and J. F. Englehorn, of Nez Perce, are building a power plant with a capacity of 200 horsepower near Orofino, Ida. A.

TACOMA, WASH.—The commissioner of public works of Tacoma is advertising for proposals to furnish a fifty-arc, air-cooled, constant-current transformer. A.

SAN FRANCISCO, CAL.—An additional $500,000 of the Northern California Power Consolidated 5's has been sold and the proceeds are being invested in the development of the plant.

DELHI, IOWA—An electric light plant costing $18,000 will be installed at Delhi. The town has raised $8,000 and outside capital will supply $10,000. Power will be furnished to small factories. C.

SEATTLE, WASH.—The city of Seattle will vote on December 29 on issuing $800,000 four-and-one-half-per-cent lighting bonds, together with two other bond propositions for ratification or redemption.

ALBANY, N. Y.—The Public Service Commission, second district, has authorized the Rockland Light and Power Company, of Nyack, N. Y., to issue $500,000 five-per-cent thirty-year mortgage bonds.

SEATTLE, WASH.—The City Council of Seattle has passed an ordinance adopting plans and specifications for the enlarging and extending of the municipal light and power system at a cost of about $800,000. A.

VILLISCA, IOWA—The Villisca Electric Company has secured a temporary injunction against the city of Villisca to enjoin the granting of a franchise to F. P. Tyler, who proposes to construct a rival electric-light plant.

PLACERVILLE, CAL.—George L. Threlkel, of Placerville, Cal., has appropriated 10,000 miners' inches of water from the North Fork of the American River in El Dorado County, California, for power purposes. A.

LA GRANGE, CAL.—The work of building a thirty-two-mile transmission line from the plant of the La Grange Power Company, near La Grange, to the town of Turlock, has been begun and is to be completed within three months.

FLORA, IND.—Lincoln Hesler, who appeared before the town board in the interest of William B. LaBaw and Guy W. LaBaw, of Veedersburg, who wish to secure a franchise for building an electric-light plant, was successful in having the franchise drafted by the board.

ST. LOUIS, MO.—The proposed artistic electroliers on downtown streets will be illuminated for the first time on Centennial Day, November 2, 1909, if the plans of the Downtown Lighting Association, organized at a meeting of business men with a committee of the Civic League, at the Mercantile Club, do not miscarry. Tom W. Bennett was elected president of the association; Dan C. Nugent, vice-president, and Thomas H. West, Jr., treasurer. Committees for each street in the district are to be appointed by the executive committee, to enlist all the property holders as members of the association and to superintend the erection of electroliers in conformity with the patterns selected by a committee of the association.

PORTLAND, ORE.—The Portland Railway, Light and Power Company has plans nearly completed for a two-story concrete and brick transmission station, fifty by one hundred feet, at First and Jefferson Streets, Portland.

ELLWOOD CITY, PA.—As a result of the action taken in Council Ellwood will not have a municipal electric-light plant. The vote for a bond issue of $12,000 for repairing the old lighting plant was lost by a single ballot.

SEATTLE, WASH.—G. W. Wilson, of Seattle, has plans under way for a power plant to supply the towns of Bothell and Woodinville in the same state. He has filed a notice of appropriation of water from North Creek for power purposes. A.

PRESCOTT, ARIZ.—M. J. Hickey, Robert Brown and Henry T. Andrews have secured a franchise for an electric-light and power system at Prescott. The ordinance also permits of the building and operating of telephone and telegraph lines in the city. A.

GREEN BAY, WIS.—The Northern Hydro-electric Company of Green Bay will shortly let contracts for the construction of a dam and power house at High Falls on the Peshtigo River in Stephenson County, Mich. The company will develop 7,500 horsepower. C.

MOROCCO, IND.—The Morocco electric-light plant, formerly owned by W. J. Harpole and Company, has been sold to J. C. Carpenter, a prominent electric-light man. It is the purpose of the new owner to improve the plant and install modern machinery. S.

FORT WAYNE, IND.—The city has just taken possession of its municipal plant for street lighting and, finding it has surplus power, desires to sell it to private consumers at eight cents a kilowatt, whereas customers of the traction company pay a net rate of ten cents.

TONOPAH, NEV.—The Nevada-California Power Company, which recently completed three units of its plant near Tonopah, Nev., with a capacity of 23,000 horsepower, has completed preliminary surveys for its Manhattan and Round Mountain extensions as far as Central, twelve miles from Manhattan. From that point separate lines will be run to the two camps. A.

SAN FRANCISCO, CAL.—The Northern California Power Company, Consolidated, of San Francisco, recently organized, has given a deed of trust to the Union Trust Company of San Francisco, to secure a bonded indebtedness of $10,000,000. Most of the new bond issue will be used in taking up the floating and bonded indebtedness of the companies merged into the consolidated company. A.

SAN FRANCISCO, CAL.—The board of public works announces that it will award the contract for turbines and pumps for the proposed power stations of the auxiliary fire-protective system and for two fire boats to the Byron Jackson Iron Works, notwithstanding that the company's bid was about $7,000 higher than that of the D'Olier Engineering Company of Philadelphia. The contract will approximate $120,000. A.

ST. ANTHONY, IDA.—The St. Anthony Light and Power Company has begun the work of connecting its plant at that place with the plants at Teton City and Rexburg. Next spring the company will build a hydro-electric plant at its site on the Teton River for the supplying of the three lighting systems. The power plant will develop 3,000 horsepower and, with the necessary buildings, power lines and connections, will cost about $150,000. A.

PORT ORCHARD, WASH.—Members of a new power company are visiting Port Orchard, Bremerton, Charleston and other towns in Kitsap County with a project to light these towns with electricity. The promoters plan to utilize the power of the Dosewallup River on the west side of Hood Canal, equipping a plant costing $250,000. The members of the company made plans to apply for the right to furnish light and power to the navy yard at ten cents per kilowatt-hour.

BOSTON, MASS.—The Minneapolis General Electric Company has sold to Blodget, Merritt & Co. $1,100,000 first mortgage five-per-cent bonds, due December, 1934. The proceeds will be used for retirement of one-year six-per-cent notes, maturing December 16, 1908, and will fund floating indebtedness which represents costs of permanent additions to property during the past two years. This company controls all the electric lighting and commercial power business in Minneapolis.

EDUCATIONAL.

WORCESTER POLYTECHNIC INSTITUTE—The electrical engineering department of Worcester Polytechnic Institute, Worcester, Mass., is adequately described and illustrated in a handsome little pamphlet published by the Institute. The very complete electrical laboratory and electric test-car equipment make this institution one of the best equipped in the country. Prof. Harold B. Smith is at the head of the department.

PERSONAL MENTION.

MR. H. D. MURDOCK, who has been mechanical and electrical engineer of the Indianapolis & Louisville Traction Company for the past year, at Scottsburg, Ind., has been appointed superintendent of the company.

MR. HOWARD R. SHARKEY, who is well known to the electrical trade, has joined the forces of the Diamond Rubber Company of Akron, Ohio, and will handle its wire in the East, with headquarters at 1876 Broadway, New York city.

PROF. ERNEST RUTHERFORD, director of the physical laboratory of the University of Manchester, England, and PROF. GABRIEL LIPPMAN, of the University of Paris, have received the awards of the Nobel Prizes for chemistry and physics, respectively, in recognition of their distinguished work in scientific discoveries.

MR. FRANK J. SLOAT, general manager of the Ohio Traction Company, the largest interurban system in Ohio, has resigned to take up mining operations in California. Mr. Sloat has operated all the Schoepf syndicate's properties in southern Ohio for years, and was formerly president of the Ohio State Interurban Association. S.

MR. LOUIS A. FERGUSON, president of the American Institute of Electrical Engineers, and vice-president of the Commonwealth Edison Company of Chicago, was the speaker of the evening at the December dinner and meeting of the Electrical Engineering Society of the Massachusetts Institute of Technology, Boston, December 9. Mr. Ferguson is a graduate of the Tech class of 1888.

OBITUARY.

MRS. ELIZA McGUIRE HAASE, who died December 8, was the mother of Allen Lee Haase, the well-known representative of the Harvard Electric Company, Chicago.

MR. MYRON T. WILBUR, treasurer of the American District Telegraph Company and of the Western Union Telegraph Company, died on Tuesday, December 8, at his home in New York city, after an illness of ten days. Mr. Wilbur was sixty-two years of age and is survived by Mrs. Wilbur, his widow. He was in every respect a fine man, with a host of warm friends and close acquaintances, who with us will deeply deplore his passing.

NEW MANUFACTURING COMPANIES.

HORNELL, N. Y.—The A. J. Deer Company has been incorporated to manufacture motors, electric novelties, electric machinery, dynamos, etc. Capital, $120,000. Incorporators: A. J. Deer, Buffalo; F. Bartz, F. A. Wygant, Hornell.

ALBANY, N. Y.—The Butler Electric Clutch Company, of Yonkers, has been incorporated with a capital of $50,000. The directors for the first year are as follows: Wm. W. Butler, Martin E. Thew and Clarence Alexander, of Yonkers.

NORFOLK, VA.—The Virginia Auto-Electric Piano Company, of Norfolk, has been incorporated with D. E. Levy, president, and Moe Levy, secretary and treasurer. The capital stock is placed at $5,000 to $15,000, and the company will manufacture pianos.

ROCHESTER, N. Y.—The Iternational Telechronometer Company, Rochester, has been formed to execute electrical work of all kinds. Its capital is $500,000, and incorporators are George S. McMillan, James W. Lewis, Clarence W. McKay, Merton E. Lewis, Rochester, and Victor B. Deyber, Albany.

MINNEAPOLIS, MINN.—The Northern Electrical Company and the Electrical Engineering Company, both of Minneapolis, have been merged, James Richardson, president, and W. E. Stephenson, manager, of the former company, having bought G. W. Hayford's interest in the latter. The officers of the consolidated company are: Morgan Brooks, president; James Richardson, vice-president, and W. E. Stephenson, secretary and treasurer. The business will be continued at 21 Sixth Street. C.

PROPOSALS.

POSTOFFICE AT WARREN, OHIO—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until January 12 for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the United States Postoffice at Warren, Ohio, in accordance with specifications, which may be had from the custodian of site at Warren, or at the office of the Supervising Architect.

STATE CAPITOL OF KENTUCKY—Sealed proposals will be received at the office of the Board of State Capitol Commissioners at Frankfort to January 5 for the manufacture and installation of the electric-light fixtures required in the new State Capitol Building, Frankfort. Plans and specifications for the work may be seen at the offices of the architects, Frank M. Andrews & Company, Cincinnati, Ohio, and Waldorf-Astoria, New York city. Bids must be addressed to Edward M. Drane, secretary Board of State Capitol Commissioners, and must be accompanied by certified check for at least five per cent of the amount of the bid.

ELECTRICAL SECURITIES.

Although the markets have continued irregular, increased activity has been the rule, and the general price movement has been upward. The average price of railroad shares made a new high level for the year and the industrial average also registered a good advance. Public buying was more active, and this is contrary to general expectations. For the first time since election there has been a genuine concession in quarters which were heretofore pessimistic regarding the increasing business revival. The declaration of the first dividend on its preferred stock by the Wisconsin Central, and the increase in the dividend rate of the Western Union, were minor factors in bringing about increased confidence in the financial community.

Dividends have been declared upon the following electrical securities: Reading Traction Company; regular quarterly dividend of seventy-five cents a share, payable January 1 to stock of record December 11. United Gas Improvement Company; regular quarterly dividend of two per cent, payable January 15 to stock of record December 31. Regular quarterly dividend of one-and-one-half per cent on the preferred stock of the Duluth Edison Electric Company, payable on the first day of January, 1909, to stockholders of record at the close of business on December 12. Manhattan Railway Company; regular quarterly dividend of one-and-three-fourths per cent, payable January 1. Union Traction Company, Philadelphia; semi-annual dividend of three per cent, placing the stock on a six per cent per annum basis. The stock has heretofore been on a five per cent per annum basis. The dividend is payable January 1 to stock of record December 10. Semi-annual dividend of $3 per share on the preferred stock of the Columbus Electric Company, payable January 1, 1909, to stock of record December 21, 1908. Canadian General Electric Company, Limited; regular quarterly dividend of one-and-three-fourths per cent on its common stock, payable January 1. Books closed December 14, reopen January 1. Central District and Printing Telegraph Company; regular quarterly dividend of two per cent, payable January 20 to stock of record January 23. Bangor Railway and Electric Company; quarterly dividend of one-and-one-fourth per cent, payable January 1 to holders of record December 20. El Paso Electric Railway; a dividend of three per cent on the preferred, payable January 11 to stock of record December 30. Halifax Electric Tramway; a dividend of one-and-one-half per cent, payable January 2. Lynchburg Traction and Light Company; one-and-one-half per cent, and an extra dividend of one per cent, payable December 15. Portland (Ore.) Railway, Light and Power Company; a dividend of one-and-one-fourth per cent, payable January 2. Sao Paulo Tramway, Light and Power Company; quarterly dividend of two-and-one-half per cent, payable January 2. Union Passenger Railway, Philadelphia; semi-annual dividend of $4.75, payable January 1. West Philadelphia Passenger Railway; semi-annual dividend of $5, payable January 1.

ELECTRICAL SECURITIES FOR THE WEEK ENDED DECEMBER 12.

New York:	*Closing.*
Allis-Chalmers common	16
Allis-Chalmers preferred	52⅜
Brooklyn Rapid Transit	58
American Telephone and Telegraph Company	128¾
General Electric	158¼
Interborough-Metropolitan common	17⅛
Interborough-Metropolitan preferred	41⅛
Kings County Electric	126
Mackay Companies (Postal Telegraph and Cable) common	74¼
Mackay Companies (Postal Telegraph and Cable) preferred	69
Manhattan Elevated	147
Metropolitan Street Railway	31¾
New York and New Jersey Telephone	114
Western Union	68
Westinghouse Manufacturing Company	88
Boston:	*Closing.*
Edison Electric Illuminating	240
Massachusetts Electric	58½
New England Telephone	127
Western Telephone and Telegraph pref	78
Philadelphia:	*Closing.*
Electric Company of America	10⅞
Electric Storage Battery common	44¾
Electric Storage Battery preferred	44¾
Philadelphia Electric	11¼
Philadelphia Rapid Transit	22½
United Gas Improvement	92¼
Chicago:	*Closing.*
Chicago Telephone	129½
Commonwealth Edison	104
Metropolitan Elevated preferred	48¾
National Carbon common	86
National Carbon preferred	113

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

HOLLIS, OKLA.—The Hollis Telephone Company has been incorporated with a capital stock of $20,000. P.

DALLAS, S. D.—The Tripp-Myer Telephone Company has been incorporated with a capital stock of $10,000.

WARSAW, IND.—The Commercial Telephone Company is in the market for material to construct a new circuit, six miles in length. The line is to be completed by January 15. S.

FARGO, N. D.—The agreement for exchanging local and long-distance service in North Dakota between the Independents and the Bell company has resulted in a revision of rates which amounts to an advance. C.

SHIRLEY, IND.—The Farmers' Mutual Telephone Company, of Shirley, has been sold with all rights, property and franchises, to H. N. Rhorer, of Greenfield, Mo. The new owner is an experienced telephone man and says that he will remodel, re-equip and extend the plant. S.

INDEPENDENCE, CAL.—The board of supervisors of Inyo County, California, is advertising for bids for a telephone franchise to connect the towns of Independence, Lone Pine, Keeler, Darwin, Ballarat and Skidoo with a telephone line. Bids will be received until January 5. A.

SAN FRANCISCO, CAL.—J. C. Rohlfs, manager at San Francisco for the marine department of the Standard Oil Company, has arranged to equip the company's steamers Atlas, Asuncion and Maverick and barge 91 with the United Wireless Telegraph Company's system of wireless telegraph apparatus. A.

SEATTLE, WASH.—The Pacific States Telephone and Telegraph Company, of San Francisco, is planning the expenditure of about $600,000 on its system at Seattle. The improvements include a new telephone exchange in the Beacon Hill district, the laying of permanent underground conduits and the placing of other equipment. A.

MINNEAPOLIS, MINN.—Toll coupons for long-distance service, which are sold at a discount, are held to be illegal as being discriminatory, under the state anti-pass law of Minnesota, according to an opinion by the attorney-general's department. The Tri-State Telephone Company refuses to accept the ruling and may not withdraw them without further investigation. C.

HONOLULU, H. I.—Clinton J. Hutchins, of San Francisco, who is manager of the Island Wireless Telegraph Company, of Honolulu, has placed a contract with the Automatic Electric Company, of Chicago, for automatic telephones and will put in a telephone system in Honolulu. The company already holds franchises under which the work can be done. An application has been made to increase the capital stock of the company from $150,000 to $1,000,000, and to change the name to the Hawaiian Telegraph and Telephone Company. The Honolulu system will be operated in connection with the company's inter-island wireless system. Mr. Hutchins' plans also include the building of a $50,000 central exchange and office building on a site recently purchased in Honolulu. A.

ENGINEERING SOCIETIES.

STEVENS ENGINEERING SOCIETY—The American Society of Mechanical Engineers has established its first student section by affiliating with itself the Stevens Engineering Society of Stevens Institute of Technology, Hoboken, N. J. It is believed that other student organizations will be similarly favored. Though these undergraduate associations will retain their personnel and autonomy, it is expected that both the allied societies as well as the American Society of Mechanical Engineers will benefit from this closer contact of the engineer and the engineer-student.

FT. WAYNE ELECTRO TECHNIC CLUB—One of the most profitable meetings of the Electro Technic Club of Ft. Wayne, Ind., organized from among the employes of the Ft. Wayne Electric Company, was held December 1. The principal address was made by Prof. J. W. Esterline of Purdue University on "The Commercial Testing of Raw Material." Professor Esterline confined his discussion of the subject particularly to materials entering into the manufacture of electrical apparatus and cited many instances of the necessity for tests he found in his work as consulting engineer for a umber of Indiana cities in the installation of electric-light and power plants. S.

DATES AHEAD.

American Roentgen-Ray Society. Annual meeting, New York city, December 28-30.

American Association for the Advancement of Science. Annual meeting, Baltimore, Md., December 28-January 2.

Chicago Electrical Show. Coliseum, Chicago, Ill., January 16-30, 1909.

Northwestern Electrical Association. Annual meeting, Milwaukee, Wis., January, 1909.

American Association of Electric Motor Manufacturers. Next meeting, January, 1909.

LEGAL NOTES.

Conducted by J. L. Rosenberger, LL.D.

SUFFICIENT FULFILLMENT OF DUTY IN FURNISHING OF CONTROLLER—An electric passenger-carrier fulfills its duty, so far as the controller of an electric car is concerned, the Supreme Court of Minnesota holds, Jenkins vs. St. Paul City Railway Company, 117 Northwestern Reporter, 928, if the controller is shown to have been of standard character, made by a reputable manufacturer, in good condition, and to have been subjected to such inspection as is reasonable and practicable. The carrier is required to inspect with adequate care, but not to dismantle complicated machinery for purposes of inspection. In this case, the plaintiff, a man of at least ordinary intelligence, an instructed and experienced motorman, was injured while operating an electric car at a terminal where the cars turned round a loop. The car ran upon the curve of the loop at full speed and was derailed and capsized. The issue was whether a shock of electricity, passing through the plaintiff from his left hand, on the handle of the controller, and through his foot, resting upon a metallic part of the car, produced temporary paralysis, by reason of which he was deprived of control of his car. The court holds that the presumption of negligence conceded from the happening of the accident was rebutted by affirmative testimony, among other things, as to the safe use of the car for twenty days before and months after the occurrence of the accident, during which the car was shown to have been in the same condition as at the time of the accident, and by facts shown as to its purchase and inspection.

ELECTRIC LIGHT AND POWER COMPANY NOT LIABLE FOR INJURY TO BOY IN HOT-WATER WELL—In an open space adjoining an electric light and power station, and about sixty-two feet from the street, was an alleged defectively-covered hot-water well, into which a boy of thirteen fell. For the purpose of bringing himself within the class of cases decided by the courts imposing a higher degree of care upon persons having upon their premises structures or others things which are calculated to attract children, he said "the machinery, being constantly in motion, is calculated to attract and allure the boys, etc., to see the machinery." But the Supreme Court of North Carolina holds that it was error to overrule a demurrer to the complaint based upon the failure of the plaintiff to allege any facts showing that the company owed him any duty in relation to placing, using, or covering the wells upon its premises. The court says, among other things, Briscoe vs. Henderson Lighting and Power Company, 62 Southeastern Reporter, 600, that one may well use a portion of his private lot as an alley for domestic purposes, or a manufacturing establishment, or, as in this case, an electric-light plant, for uses connected with his or its business, without subjecting it to a public use. Of course, if, so used, its servants or others who are invited or entitled to pass over it are injured by pitfalls or obstructions placed there, the owner of the premises is liable. The present case illustrates the fallacy of the theory of implied invitation. Would it ever occur to any reasonable mind that constructing the building with large windows and doors, placing in it the engines, dynamos, and other machinery, and keeping them constantly in motion, for the purpose of discharging its corporate functions and duties, however attractive to small boys, was an invitation to them to make the premises a playground? To adopt the suggestion carries us too far afield for the practical affairs of life, and violates manifest truth. It must be conceded that the liability for injuries to children by reason of dangerous conditions on one's premises is recognized and enforced in cases in which no such liability accrues to adults. But, in the court's view, the defendant company did not owe any duty to the plaintiff to cover the well at all, as it was under no obligation to anticipate that he would come upon its premises. If, as the court holds, he was an unexpected trespasser, and not within the exception to the general rule, it was his duty to look out for danger, and not the duty of the defendant to provide against danger. If the municipal authorities deem the conditions described as dangerous to the public, they may require the owners to guard or fence the premises. In this way the conditions are met without imposing unreasonable burdens upon property owners.

ELECTRIC RAILWAYS.

(Special Correspondence.)

GREAT FALLS, MONT.—An electric line from Great Falls to Choteau is projected. C.

INDIANAPOLIS, IND.—The Indianapolis Traction and Terminal Company is in the market for about fifty new and modern street cars. S.

TOLEDO, O.—The annual meeting of the Toledo Railways and Light Company will be held in Toledo on January 21. Books close January 9 and reopen January 22.

CHICAGO, ILL.—The Chicago & Northwestern Railroad has contracted for sixty miles of electric-block signaling, to complete the equipment of its double track from Chicago to the Missouri River.

DUBUQUE, IOWA—The name of the Dubuque-Platteville interurban road of Dubuque has been changed to the Dubuque, Iowa & Wisconsin Railway, and it is authoritatively stated that the road will be built. C.

BOSTON, MASS.—The Connecticut Valley Street Railway has filed a petition with the Massachusetts secretary of state asking authority from the Legislature to issue bonds for refunding or paying current indebtedness.

SAN DIEGO, CAL.—The San Diego Electric Railway Company has taken preliminary steps to create a bonded indebtedness of $5,000,000, for the consolidation of existing debts and for betterments and extensions. A.

BILLINGS, MONT.—The business men of Billings have taken up the proposition to build an electric line to Laurel, Mont., and will attempt to secure $100,000 subscriptions to the stock of the Billings & Cook City Railway Company. C.

PHILADELPHIA, PA.—There have been listed on the Philadelphia Stock Exchange $6,966,000 first consolidated mortgage five-per-cent thirty-year bonds of the Fort Wayne & Wabash Valley Traction Company, due March 1, 1934.

NEW YORK, N. Y.—Within the next sixty days the New York Central Railroad Company will begin the work of electrifying the present two tracks of the Harlem division from Wakefield to White Plains, a distance of about twelve miles.

BROWNSTOWN, IND.—The county commissioners have ordered a special election to be held in Brownstown and Jackson townships, January 11, to vote upon the matter of a subsidy in aid of electric lines between Brownstown and Seymour, to connect at the latter place with the Indianapolis & Louisville traction line. S.

GOLDFIELD, NEV.—The Esmeraldo County commissioners have granted a franchise to George Wingfield, L. T. Merwin and Thomas F. Manning of Goldfield for an electric railway through the streets of Goldfield and Columbia; the lines will also be extended to Diamondfield, hauling both passengers and freight. Work must commence within sixty days.

OAKLAND, CAL.—Randall, Trowbridge and Company, of Oakland, Cal., have applied for a fifty-year franchise for an electric-railway system covering the principal streets of the town of Vallejo, on the north side of San Francisco Bay. The application declares that if the franchise is secured work will begin within one year and be finished within two years. A.

MAYSVILLE, IND.—A number of capitalists interested in the construction of an interurban line from Bryan, Ohio, to Fort Wayne, Ind., via Maysville, held a meeting December 8. Messrs. Tenniss and Doan, of Philadelphia, who are backing the project, were present and explained in detail the plans and aims of the company. Springfield Township has voted a $10,000 subsidy in aid of the construction of this road, the work to begin early in the spring. S.

TOLEDO, OHIO—It is expected that within a year an interurban railroad will be in operation between Columbus and Toledo. It is thought the construction will be resumed early in the spring on the middle section known as the Findlay-Marion Line. Findlay business men have agreed to take $100,000 worth of stock, and those of Mt. Blanchard will take $20,000, while another $100,000 has been subscribed by the merchants of Marion. The Findlay-Marion line will connect for Toledo with the Toledo Urban and Interurban at Findlay, and with the Columbus, Delaware & Marion traction line at Marion. H.

DWIGHT, ILL.—In order to meet trolley competition and to determine by a fair trial the results of the operation of a coach on a frequent schedule, the Chicago & Alton Railroad has determined to put in operation a motor-car passenger service between Alton and Dwight, a distance of fifty miles. If this experiment is satisfactory the service will be extended to other points. The equipment to be used is a Strang gas-electric motor car, a counterpart of the car which made the run from the Atlantic to the Pacific coast via Toledo, several years ago. The motor is the invention of W. B. Strang, who built the Detroit & Toledo Shore line. H.

CHICAGO, ILL.—Traffic of the three principal local elevated railroad companies in November shows only a slight change in the direction of improvement, which would indicate there has been some increase in general business of the city. Metropolitan's decrease in its daily average traffic was 10,074 passengers compared with a year ago. In the preceding month the road's decrease by similar comparison was nearly 14,000 passengers a day. South Side's November traffic shows a loss of 2,785 passengers a day compared with a year ago, while in October the decrease was more than 4,000. Northwestern maintains its gain over a year ago, due largely to the fact that the Evanston branch of the road was not in operation a year ago. The November increase, compared with last year, was 10,153 passengers a day; in October the gain was 9,204 passengers.

INDUSTRIAL ITEMS.

THE NERNST LAMP COMPANY, Pittsburg, Pa., shows a number of attractive illustrations of Nernst installations in the current number of *Lux*.

THE BUFFALO SPECIALTY COMPANY, Buffalo, N. Y., is offering an Elgin gold watch as a premium to those who order, on sixty days' time, a sixty-pound drum of electric belt dressing.

THE HILL CLUTCH COMPANY, Cleveland, Ohio, has published a supplemental catalogue describing and listing its friction-clutch pulleys and couplings, together with the necessary accessories and extra parts.

THE STANDARD ROLLER BEARING COMPANY, Philadelphia, Pa., under date of December 1, issues Catalogue 24, which is especially complete in listing the many types of ball and roller bearings manufactured by this company.

THE BABCOCK & WILCOX COMPANY, New York, has purchased from the Rust Boiler Company its patents and plant located at Midland, Pa., and will continue the manufacture at that point of the Rust water-tube boiler.

THE WESTERN ELECTRIC COMPANY, Chicago, Ill., has arranged pamphlets containing useful and valuable instructions for the installation and operation of its Design E and Design L generators and motors. The instruction booklets are very completely illustrated.

THE WESTERN ELECTRIC COMPANY, Chicago, Ill., is distributing a new bulletin devoted to its three-wire generator. This generator has only one slip ring, and no auxiliary apparatus is necessary for its operation. Copies of this bulletin will be furnished to those interested upon request.

THE METROPOLITAN ELECTRICAL SUPPLY COMPANY, Chicago, Ill., is making extensive improvements in its office and shelving. The business of this company is on the steady increase, and with its added facilities it will be better prepared than ever to make prompt and careful shipments of all orders.

THE MODEL GAS ENGINE WORKS, Peru, Ind., has an instruction pamphlet entitled, "How to Burn Less Coal," in which it is shown that two-thirds of the coal burned under a boiler is uselessly wasted. The use of gas engines is advocated. The Model Gas Engine Works manufacture gas engines and equipment for a number of purposes and operating on a variety of fuels.

THE YALE & TOWNE MANUFACTURING COMPANY, New York, makers of Yale locks, builders' hardware, chain blocks and electric hoists, has just issued its chain block catalogue, describing its line of chain hoists, both hand and electric, and also trolleys, trolley tracks, etc. This is a rather more expensive and carefully considered production than any of the company's previous books.

THE PETTINGELL-ANDREWS COMPANY, Pearl Street and Atlantic Avenue, Boston, Mass., is distributing a handsome booklet devoted to an exposition of its inexpensive and attractive reading lamps. This booklet should be of particular interest at this time in view of the possibility of selecting these goods for the holiday season. The typographical appearance of the booklet is worthy of extra mention, and the cover paper, which was imported from Italy for this production, adds greatly to the attractiveness of this little souvenir.

THE NEW PROCESS RAW HIDE COMPANY, Syracuse, N. Y., manufacturer of New Process pinions and cut gears, is constructing a considerable addition to its present plant. The company is now working its factory nights to meet orders with its present plant and force. The new addition, which is under construction, will consist of two stories and a basement, sixty feet by eighty feet, adjoining the present plant. The building is to be of steel and brick with cement floors and will increase the available floor space by over 13,000 square feet. The cost complete will be about $30,000. The company has machinery on order for delivery during the next two months approximating $12,000. This comprises principally automatic turret lathes, bevel gear planers and grinding machines An additional hardening furnace for treating automobile transmission gears and drive gears will also be installed. The company reports the total of the orders at present on its books to be in excess of any time in its history.

THE NATIONAL METAL MOLDING COMPANY, Pittsburg, Pa., has met the increasing demand for a metal molding, neat in construction and easy to install, with the production of National metal molding. This molding consists of two pieces, a base and capping. The base is furnished with countersunk holes to accommodate screws or bolts to fasten same securely to walls or ceilings. After the base and base fittings are installed and the wires laid in, the capping is "snapped on." Various fittings are supplied. National metal molding, attachments and tools are explained in full in a booklet just issued by the National company.

DOSSERT & COMPANY, 242 West Forty-first Street, New York city, announce that they have received an order from the Chicago City Railway Company for seventy-five special solderless two-way connectors for 1,000,000-circular-mil cable, and also an order for a large quantity of strain clamps for 750,000-circular-mil cable and solderless two-way connectors for 1,500,000-circular-mil cable from Gollatly & Company, Pittsburg, Pa. They have also received orders from the United Electric Light and Power Company of New York city for a large number of standard and special solderless connectors for use in its One-Hundred-and-Forty-sixth Street substation.

THE TRIUMPH ELECTRIC COMPANY, Cincinnati, O., manufacturer of Triumph electric light and power machinery, announces the following sales recently made: Greenpoint Metallic Bed Company, Greenpoint, L. I., one 200-kilowatt generator and twenty motors, ranging from ten to thirty horsepower and aggregating 400 horsepower; Rapid Motor Vehicle Company, Pontiac, Mich., one 100-kilowatt engine-type generator; Lake Erie Provision Company, Cleveland, O., one fifty-kilowatt engine-type generator and one seventy-five-kilowatt engine-type generator; Lamb-Fish Lumber Company, Charleston, Miss., one 125-kilowatt engine-type generator; Rehbun Last Company, Cincinnati, O., one 100-kilowatt engine-type generator; Robert Mitchell Furniture Company, Cincinnati, O., one seventy-five-kilowatt engine-type generator.

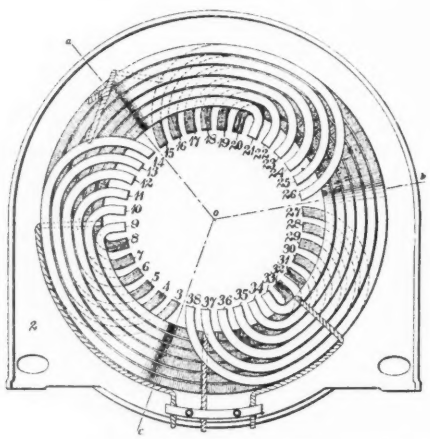
RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) December 8, 1908.

905,827. INGOT-STRIPPER. Henry Aiken, Pittsburg, Pa. Filed September 18, 1905. Has a movable crane carriage, a cylinder and a plunger suspended therefrom and a pump and an auxiliary electric motor mounted thereon.

905,837. ELECTROLYTE. Edward C. Broadwell, Chicago, Ill., assignor to J. W. Meaker, Jr., Chicago, Ill. Filed August 20, 1906. Contains zinc sulphate and zinc naphthalene disulphonate.

905,848. ELECTRIC-MOTOR-CONTROL SYSTEM. William Cooper, Wilkinsburg, and Olof A. Sandborgh, Swissville, Pa., assignors to Westinghouse Electric and Manufacturing Company. Filed January 3, 1906. In combination with a number of dissimilar electrically-operated car-motor-control systems are means for effecting their concurrent operation.



905,900.—ARRANGEMENT OF END CONNECTORS OF A STATOR WINDING.

905,854. TESTING SYSTEM FOR TELEPHONE LINES. William W. Dean, Chicago, Ill., assignor to Kellogg Switchboard and Supply Company, Chicago, Ill. Filed June 29, 1903. The connection of a high-resistance testing device with each cord circuit is controlled through contacts of the listening key and supervisory relay.

905,868. COIL SUPPORT FOR DYNAMO-ELECTRIC MACHINES. Israel L. Griffith, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed June 28, 1905. A supporting bracket has a number of divergent arms to engage insulating strips.

905,874. AIR-COOLING DEVICE. George W. Haverstick, St. Louis, Mo. Filed November 29, 1907. Electric fans are placed adjacent the opposite ends of a casing containing troughs arranged horizontally and means for throwing a spray of water into the troughs.

905,875. CAR-TESTING DEVICE. Albert B. Herrick, Ridgewood, N. J. Filed May 31, 1905. An electrical testing device contains instruments for measuring the resistance of a circuit and for measuring its insulation.

905,889. COIL-SUPPORT FOR DYNAMO-ELECTRIC MACHINERY. Benjamin G. Lamme, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed June 28, 1905. Relates to further details for the device covered by No. 905,868.

905,900. WINDING FOR DYNAMO-ELECTRIC MACHINES. George R. Maxwell, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed June 16, 1905. Renewed April 10, 1908. A number of groups of coils are provided with similar groups of end connectors, the main portions of which are located in parallel planes and overlap each other.

905,905. ELECTRIC CUT-OUT AND HOLDER. Thomas E. Murray, New York, N. Y. Filed March 13, 1908. The holder has two recesses, circuit terminals disposed therein and a cut-out in loop form having its ends constructed to enter the recesses.

905,907. TRANSMITTER BRACKET. Ernest S. McLarn, New York, N. Y., assignor to Western Electric Company, Chicago, Ill. Filed June 10, 1908. The bracket consists of sheet metal provided with bosses, between which the transmitter arm is supported and pivoted.

905,922. ELECTRICAL APPARATUS. Karl C. Randall, Edgewood Park, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed April 5, 1907. A transformer, a circuit interrupter and a protective device are mounted in an oil tank.

905,930. TWO-PHASE ALTERNATING-CURRENT DISTRIBUTION. Herbert S. Russell, Hanwell, and Frederick E. Berry, West Drayton, England. Filed May 6, 1907. A booster transformer has its boosted winding in the common return and its two primary windings connected respectively between the separate phase conductors and the common return.

905,933. ELECTRIC-CIRCUIT MAKING AND BREAKING DEVICE. John Ryan, Columbus, O. Filed June 8, 1907. A rotative shaft carries a number of metallic segments over which ride a number of pivoted metallic arms.

905,934. ELECTRICITY METER. Gustave A. Scheeffer, Indianapolis, Ind. Filed January 15, 1907. An armature formed of three coils is locked and manually interlocked on the armature spindle.

905,935. SPARKER DEVICE. Erich Schietzel, Wilkesbarre, Pa. Filed January 8, 1908. A set of three contacts is carried by a plunger normally engaged by a core of the electromagnet.

905,940. HIGH-TENSION INSULATOR. Guido Semenza, Milan, Italy. Filed February 5, 1906. The top section has a wide, flat rim, below which is another rim and between them an intermediate socket and spigot distance piece.

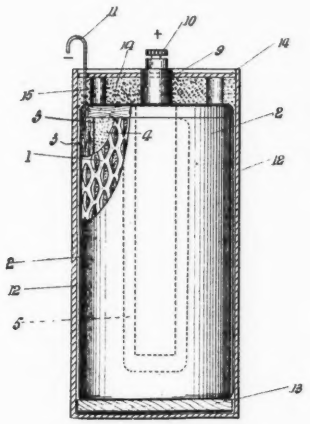
905,952. GALVANIC CELL. Joseph T. Szek, London, England. Filed September 23, 1907. A dry battery contains an expanded sheet-zinc electrode in electrical contact with the casing.

905,964. ELECTRIC-MOTOR SUSPENSION. John E. Webster, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed April 12, 1907. A single-phase car motor is mounted on a coiled spring suspension with a quill enclosing the axle of the truck.

905,966. PROCESS AND APPARATUS FOR TESTING WATT-METERS. Edgar M. Wilkins, Mexico, Mexico. Filed August 12, 1907. Involves a method of arranging a photographic shutter for observing the spot on the disc at predetermined intervals.

905,969. ELECTRIC TERMINAL POST. Asbury G. Wilson, Wilkinsburg, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. Filed October 10, 1907. A pair of spring jaws partially encloses a cylindrical carbon contact.

905,971. SYSTEM FOR ELECTRICAL DISTRIBUTION. Joseph L. Woodbridge, Philadelphia, Pa. Filed November 13, 1907. Associated with a rotary converter is an alternator connected between it and the alternating-current source and developing an electromotive force at right angles to that of the converter.



905,952.—DRY BATTERY.

905,976. TROLLEY-WIRE HANGER. William S. Arnold, Lorain, Ohio. Filed June 18, 1908. The supporting member has a socket portion and hooks adapted to receive a spanner.

905,995. ALTERNATING-CURRENT MOTOR. Ernst Danielson, Stöpsjön, Fogdhyttan, Sweden, assignor to General Electric Company. Filed June 24, 1907. A motor for three-phase operation has a winding connected with two equal phases and a transformer adapted for T-connection with the two phases to produce a balanced three-phase voltage.

905,998. ELECTRIC OUTLET BOX. Conrad J. Dorff, Chicago, Ill., assignor to Frederic Greer, Chicago, Ill. Filed June 22, 1907. Has an opening in which lies a plug, portions of which are bent to overlie the edges of the opening.

906,003. INSULATOR PIN. Charles G. Ette, St. Louis, Mo., assignor to Ette Investment Company, St. Louis, Mo. Filed January 15, 1908. A metallic pin is provided with a screw-threaded head having a longitudinal slot containing a piece of yielding material.

906,011. PRECIPITATING APPARATUS. John E. Greenawalt, Denver, Colo. Filed April 3, 1905. In a series of cells a mass of metal shavings is supported by a perforated false bottom forming the cathode, the anode being suspended on the top in a porous jar.

906,012. RAILWAY SWITCH AND SIGNAL APPARATUS. Lawrence Griffith, Yonkers, N. Y., assignor to Federal Signal Company. Filed September 20, 1905. In an electric apparatus for operating switches and signals there are a number of electrically-governed motion plates and a controlling device therefor.

906,021. CAR FOR BONDING RAILS. Albert B. Herrick, Cleveland, O., assignor to the Electric Railway Improvement Company, Cleveland, O. Filed March 25, 1905. A part of the floor can be lowered to near the rails and carries means for making electrical contact with them.

906,026. DISTRIBUTING-ARM FOR HIGH-TENSION MAGNETOS. Theodore Hubert, New York, N. Y., assignor to Charles F. Splitdorf, New York, N. Y. Filed October 17, 1907. Comprises a block of fibre, an enclosing tube and a post and contact secured to the block.

906,038. TROLLEY-CONTACT. Andrew R. K. Lauder, Schenectady, N. Y., assignor to General Electric Company. Filed March 27, 1908. A long, flat strip of conducting material is supported directly above, but separated from the trolley wire so as to be engaged by the rims of the wheel flanges.

906,055 and 906,056. AXLE-LIGHTING SYSTEM. Alexander McGary, La Grange, Ill., assignor of one-fifth to Charles Gilbert Hawley, Chicago, Ill. Filed August 11, 1905, and October 22, 1906. The generator has two armature windings, one for supplying the light circuit and the other for charging the storage battery.

906,071. MEANS FOR RECORDING METER READINGS. Samuel C. Shaffner, Chicago, Ill. Filed January 7, 1908. A lens and shutter are arranged to admit light on a photographic film when a lever is depressed.

906,081. APPARATUS FOR THE PRODUCTION OF OZONE. Jan Steynis, New York, N. Y. Filed January 24, 1908. There are means for producing the expansion of liquefied gas within hollow electrodes for absorbing the total heat developed by the stream discharges.

906,100. INDICATOR. Edward J. Burke, New York, N. Y. Filed August 1, 1906. Combined with a number of jacks is a normally rotating shaft carrying an indicator normally connected to it and means for disconnecting this when the pointer is directed toward a particular jack.

906,102. ART OF PRODUCING PIGMENTS BY ELECTROLYSIS. Edwin D. Chaplin, Boston, Mass., assignor to International Lead Companies. Filed February 3, 1906. The process of producing white lead consists in electrolytically separating an electrolyte into a solvent of lead and an alkaline hydrate.

906,103. ART OF PRODUCING LEAD SALTS BY ELECTROLYSIS. Edwin D. Chaplin, Boston, Mass., assignor to International Lead Companies. Filed February 3, 1906. Consists in electrolytically forming from ore or bullion as an anode a solution containing soluble salts of lead.

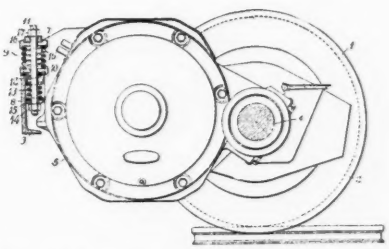
906,104. ELECTROLYTIC APPARATUS. Edwin D. Chaplin, Boston, Mass., assignor to International Lead Companies. Filed February 3, 1906. The apparatus used in the two preceding processes is described.

906,129. ELECTRIC APPARATUS FOR RAILWAY SWITCHES, SIGNALS AND THE LIKE. Lawrence Griffith, Yonkers, N. Y., assignor to Federal Signal Company. Filed April 8, 1903. This is a modification of No. 906,012.

906,160. MACHINE FOR CUTTING OUT MICA BETWEEN SEGMENTS IN COMMUTATORS. Otto F. Reinen, Los Angeles, Cal. Filed September 30, 1907. A cutter is mounted on a bracket so as to move reciprocally in a straight line.

906,161. TROLLEY DEVICE. Frank A. Robbins, Worcester, Mass. Filed November 11, 1907. The trolley harp extends normally at right angles to a trolley wire.

906,166. CAR SIGNAL. William H. Schweizer, Baltimore, Md. Filed October 8, 1907. Depression of a pedal on the platform closes the circuit of a signal over the other platform.



905,964.—ELECTRIC CAR MOTOR SUSPENSION.

906,172. PROCESS OF SMELTING ALUMINUM ORES. Frank J. Tone, Niagara Falls, N. Y., assignor to the Carborundum Company, Niagara Falls, N. Y. Filed September 14, 1907. Consists in making a mixture of aluminum silicate, carbon and a base metalliferous material and subjecting this to electrically-developed heat.

906,173. METHOD OF TREATING ALUMINUM SILICATE. Frank J. Tone, Niagara Falls, N. Y., assignor to the Carborundum Company, Niagara Falls, N. Y. Filed March 17, 1908. This is a modification of the above.

906,211. REGULATION OF THE PERIOD OR INDUCTANCE OF HIGH-FREQUENCY CIRCUITS. Gustave Ferrié, Paris, France. Filed May 8, 1907. The apparatus comprises an annular hollow conductor having a transverse gap, a conductor within this and means for regulating the resistance of the arrangement.

906,238. RAILWAY SIGNAL. Matthew M. Kane, Montgomery, Ala., assignor of one-half to William J. Gardner, Montgomery, Ala. Filed November 2, 1907. An electromagnet controls an armature lever which normally holds a set of signal wings in their "safe" position.

906,274. ELECTRIC INDICATOR. Carl von Peez, Vienna, Austria-Hungary. Filed October 4, 1907. A rotatable indication-carrier has a series of alternately and oppositely positioned teeth engaged by an armature lever under the control of an electromagnet.

906,279. TROLLEY CUT-OUT. Charles C. Phillips, Owensboro, Ky., assignor to the Phillips Automatic Signal Company, Owensboro, Ky. Filed May 9, 1907. A hanger has an arch-shaped member to the ends of which tiltable sections of the working conductor are pivoted.

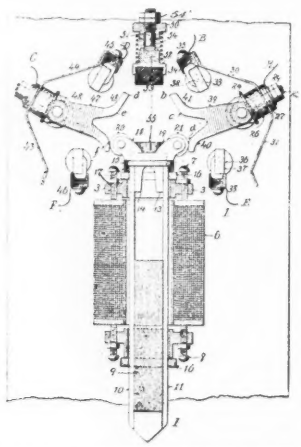
906,286. ELECTRIC-LIGHT-CORD TAKE-UP. Abraham W. Pratt, Eureka, Cal. Filed February 15, 1908. A supporting frame carries a spring-actuated reel.

906,290. SPARK-ADJUSTING STARTING MEANS FOR AUTOMOBILES. Andrew L. Riker, Short Hills, N. J., assignor to the Locomobile Company of America, New York, N. Y. Filed November 4, 1902. A governor changes the relative angular position of a rotary contact and brushes.

906,296. INSULATOR. Charles Rosenberg and Vernon T. Bailey, New York, N. Y. Filed March 18, 1908. A base of insulating material has posts at opposite sides and a socket centrally projecting from it.

906,317. ALTERNATING-CURRENT SWITCH. Frank W. Smith and Louis Larsen, New York, N. Y. Filed May 25, 1907. Combined with an electromagnet is an iron enclosing frame and a longitudinally movable core and means for maintaining equal air gas on the opposite sides of the core.

906,331. ELECTROMAGNETIC VALVE-OPERATING MECHANISM. Jacob B. Struble and Elmer R. Coe, Wilkinsburg, Pa., assignors to the Union Switch and Signal Company, Swissvale, Pa. Filed November 7, 1907. The electromagnet comprises a plunger actuated by a solenoid, a member extending through the plunger, links connected to the plunger and a yoke connected to the links and to this member.



906,317.—ALTERNATING-CURRENT SWITCH.

906,338. PROCESS OF PRODUCING SILICON. Frank J. Tone, Niagara Falls, N. Y., assignor to the Carborundum Company, Niagara Falls, N. Y. Filed September 14, 1907. A method of reducing aluminum silicate consists of forming a mixture of it and carbon and subjecting this to electrically-developed heat sufficient to reduce the silicon and to fuse the alumina.

906,357. THERMOSTAT. Alfred T. Ziegler, Allegheny, Pa. Filed September 24, 1907. There is an electrically-actuated valve in the gas-supply pipe, and electrical connections between the thermostat and the valve.

906,361. ELECTRIC SWITCH. Boyd W. Allen, Boston, Mass. Filed April 6, 1908. Comprises a rotative barrel provided with a number of teeth at different portions of its circumference, a guard and series of switches mounted thereon.

906,370. CONNECTOR FOR ELECTRICAL CONDUCTORS. Charles W. Beck, Rockville Center, N. Y. Filed March 12, 1908. Has two members pivotally connected together and provided with recesses to receive the binding post.

906,386. ROTARY SNAP-SWITCH. Charles A. Clark, Hartford, Conn., assignor to Trumbull Electric Manufacturing Company, Plainville, Conn. Filed October 24, 1907. A special construction is described.

906,405. MEANS FOR ELECTRICAL TRANSMISSION OF DESIGNS, FIGURES AND PHOTOGRAPHS. Guillermo J. de Guillén Garcia, Barcelona, Spain. Filed February 28, 1908. There are provided revolving transmitting and receiving cylinders, a plate of non-conductive material on the latter in contact with a brush in the circuit of the transmitting cylinder.

906,408. TOOL FOR ELECTRIC LAMP SOCKETS. Gilbert W. Goodridge, Bridgeport, Conn., assignor to the Bryant Electric Company, Bridgeport, Conn. Filed May 28, 1908. Has a handle and a circular head externally corrugated to fit within the corrugated flange of a socket cap.

906,411. GUARD FOR INCANDESCENT ELECTRIC LAMPS. William H. Greenwood, Everett, Mass. Filed November 7, 1907. A wire-work cage is secured to the socket by a divided cover, each part of which is pivoted to the top of the cage.

906,448. TERMINAL FOR ELECTRIC WIRES. Bernard Morgan, Newport, R. I. Filed February 6, 1908. A terminal tip is formed of sheet metal and has two wing portions adapted to grip the conductor and two spring clamp portions to engage a binding post.

906,468. PROCESS FOR THE PRODUCTION OF OZONE. Jan Steynis, New York, N. Y. Original application filed January 24, 1908. Divided and this application filed September 3, 1908. This is a modification of No. 906,081.

906,492. SAFETY DEVICE FOR RAILWAY SWITCH AND SIGNAL APPARATUS. Lawrence Griffith, Yonkers, N. Y., assignor to Federal Signal Company. Original application filed November 5, 1904. Divided and this application filed February 20, 1906. This is a modification of Nos. 906,012 and 906,192.

906,498. SHUNT OR ELECTRICAL RESISTANCE. Edward Weston, Newark, N. J. Filed March 15, 1907. A special form of ammeter shunt is described.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired December 15, 1908:

464,959. TELEPHONE. C. Cuttriss, New York, N. Y.

464,979. ELECTRIC SIGNALING APPARATUS. G. E. Miller, Lynn, Mass.

464,986. ELECTRIC CONDUCTOR. W. E. Cehrle, Philadelphia, Pa.

465,034. ELECTRIC CAR BRAKE. E. Verstraete, St. Louis, Mo.

465,078. METHOD OF CONTROLLING ALTERNATING-CURRENT INDUCTION. E. Thomson, Lynn, Mass.

465,089. RIVETING BY ELECTRICITY. E. E. Ries, Baltimore, Md.

465,104. DYNAMO-ELECTRIC MACHINE. W. P. Wiemann, Allegheny, Pa.

465,202. COUPLING FOR ELECTRIC CONDUCTORS. W. C. Preston, Providence, R. I.

465,206. PACKET OR PAD FOR ELECTRIC BATTERIES. L. H. Rogers, Brookline, Mass.

465,218. ADJUSTABLE RHEOSTAT. F. J. Sprague and C. R. Pratt, New York, N. Y.

465,233. COMMUTATOR CONNECTION FOR DYNAMO-ELECTRIC MACHINES. C. O. C. Billberg, Philadelphia, Pa.

465,234. BRUSH HOLDER FOR DYNAMO-ELECTRIC MACHINES OR MOTORS. C. O. C. Billberg, Philadelphia, Pa.

465,278. ELECTRICAL SEWER-GAS INDICATOR. J. J. Lawler, Scranton, Pa.

465,292. ELECTRIC MOTOR SWITCH. E. W. Rice, Jr., Lynn, Mass.

465,359. CONVERTER SYSTEM FOR ELECTRIC RAILWAYS. M. W. Dewey, Syracuse, N. Y.

465,360 and 465,361. ELECTRIC FAN. P. Diehl, Elizabeth, N. J.

465,365. BRACKET FOR SUPPORTING ELECTRIC CONDUCTORS. J. A. Duggan, Quincy, Mass.

465,369. PRODUCTION OF INSULATING COATINGS OR LININGS IN ELECTROLYTIC APPARATUS. L. Grabau, Hanover, Germany.

465,404. SWITCH-ACTUATING MECHANISM FOR ELECTRIC MOTORS. C. G. Armstrong, Chicago, Ill.

465,407. ELECTRIC RAILWAY. G. F. Green, Kalamazoo, Mich.

465,423. ELECTRIC HEATER. W. H. Boles, Syracuse, N. Y.

465,426. ELECTRIC SWITCH AND CASE FOR THE SAME. C. P. Chappell, Providence, R. I.

465,430. ELECTRIC CONNECTOR. W. F. Z. Desant, New York, N. Y.

465,432. ELECTRIC RAILWAY. G. F. Green, Kalamazoo, Mich.